...DEAD ASTRONOMERS REPORT..VOL.1

Part 1 : Murdered Astronomers since 1981

Dead or missing astronomers around the world

Astrophysicist Professor Kohi-Ichiro Morita (murdered astronomer in Chile)

Rodney marks mysterious death at Amundsen-Scott base.

Steven Rawlings, death...murder ....connection to one square array telescope

Part 2 : Down the rabbit hole we go

Gravity vortex imaging (ALMA in Chile)
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Kobe University
Robert Harrington's connection to Japanese astronomers and Hawaii telescope

Dr Tadashi Mukai.

Richard A Muller.

Dr Harki Mobi

Part 3 : Connecting the dots

Telescope in Alaska....linked to the Vatican intelligence service
SILOE....Vatican space telescope looking for and at HMO..(note : a satellite with a telescope inside it).
SIV.....Vatican intelligence service....servizio informazioni del Vaticano.
SVS (Secretum Omega) cosmic top secret.

Keyhole satellites

Part 4 : Coming up for air

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Part 5 : Dark Star Imaging

IRAS
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Chandra

Spitzer telescope

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Part 6 : Links / reference notes

Links to some articles plus photographs and videos

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General bits and pieces not in the general report

This report has been a collection of articles placed together to show the systematic cover up of dead astronomers all over the world. Their deaths vary from plane crashes to brain aneurysms. Most if not all these people where researching deep space with either earth based telescopes or space based telescopes. Parts two to five are articles placed together about universities, observatories and corporations connections to these deaths.

PART 1 : MURDERED ASTRONOMERS SINCE 1983…

…Koh-Ichiro Morita - Japanese Astronomer/Scientist…

Sometimes in life things can go from bad to worst…..being dead is not particularly good for one's hair style or chosen profession.
In the case of the individual above whom happens to be dead
at the moment it was an absolute tragedy….yet when one turns up dead

overnight from say, a stab wound to the head or under mysterious circumstances it would be nice in a fair world to have some truth….
But unfortunately this is a mixed up world at the best of times and truth is a word which escapes out once and a while to surface where nobody can find it….that is until now.
Facts…: Koh-Ichiro Morita was a Japanese Astronomer/Scientist living in Chile until he was murdered by a stab wound to the head….he died very soon afterwards.

Now for the propaganda….below is a remembrance note from Masahiko Hayashi..Director General... National Astronomical Observatory of Japan.

Note :
That in this remembrance note it says Koh-Ichiro Morita passed away not murdered in cold bloody from a gang member with connection to the military.

…In Remembrance of Professor Koh-Ichiro Morita…

I deeply regret that Professor Koh-Ichiro Morita passed away suddenly on May 7 (Chilean Time). I would like to extend my heartfelt condolences to his family.

Professor Morita was one of the world's renowned astronomers in the field of aperture synthesis with radio interferometric technique. In the early 1980's, he served as an assistant professor at the newly-opened Nobeyama Radio Observatory and attempted the first imaging with the aperture synthesis technique using Nobeyama Millimeter Array in Japan. During the years in Nobeyama, he took the lead in proposing a Large Millimeter Array (LMA), pointing out the importance of using a large number of antennas. The LMA Project later developed into an international project in cooperation among Japan, Europe, and North America, which led to the present ALMA (Atacama Large Millimeter/ submillimeter Array) Project under construction in Chile.

From 2010, Professor Morita served as System Verification Scientist (Lead) at the Joint ALMA Observatory (JAO). His mission was very important in verifying that images of target objects are properly synthesized at 10 times higher resolution than the Subaru Telescope by receiving radio waves with 66 antennas when completed. Since he was not only a famed expert of aperture synthesis but also a gentle and warm-hearted person, he was respected, admired, and beloved by his colleagues at the JAO.

His sudden passing was a huge loss to everyone that knew him and all the NAOJ staff share the deep sadness. Abiding by his will, we reaffirm our determination to move forward, wishing his soul may rest in peace.

May 9, 2012

Masahiko Hayashi
Director General
National Astronomical Observatory of Japan

Oh how the mighty have fallen…the propaganda and disinfo on this Japanese astronomer started as soon as he hit the pavement in Chile. His personal web/blog was taken down 6 hours after his death then the disinfo started and from that moment on the powers that be (or where) took over and ran stories to cover up all the facts…..

This is the man who stabbed Koh-Ichiro Morita …notice the tattoo on his neck which is gang related.

...Steven Rawlings, Astrophysicist...

Astrophysicist Steven Rawlings, University of Oxford in the United Kingdom, died under mysterious circumstances on Wednesday, January 11, 2012. Rawlings, age 50, was a key figure in the Square Kilometre Array(SKA) Telescope Project (read *Nature*'s News Feature on the SKA).

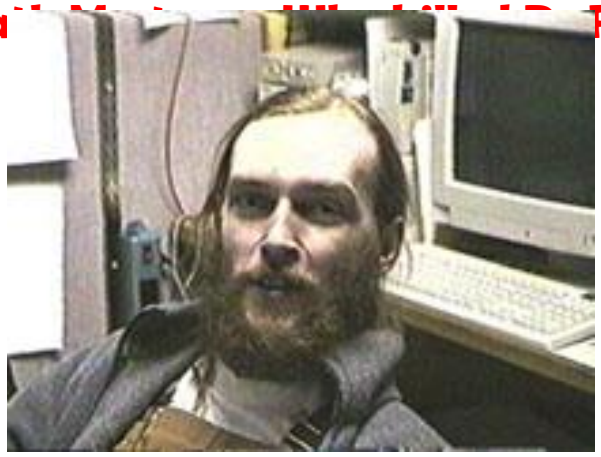
Rawlings' body was found at a bungalow in Southmoor, a small town on the outskirts of Oxford. A 49-year-old man, who was arrested on suspicion of murder, has been released on bail.

Astronomer George Miley at Leiden Observatory in the Netherlands, a friend of Rawlings for more than 20 years and vice-president of the executive committee of the International Astronomical Union described Rawlings as "the kind of person you'd want to sit down and have a beer with." According to Miley, Rawlings was a "brilliant scientist whose death will be a great loss to SKA."

Again, the greatest fear a cover-up has is an uncontrolled unraveling. There are many with good hearts, who want the public know what they are privy to as the cataclysm precursors heat up.

Was Rawlings' death a message to others of like mind? Again, you be the judge!

South Pole Dea[illegible] Rodney Marks?



Scientist Rodney Marks died at the South Pole in May 2000. Months later, tests showed he had been poisoned by a lethal dose of methanol. Dogged efforts by New Zealand authorities to investigate his puzzling death have been stonewalled by Marks' American employers. Now documents obtained under America's Freedom of Information Act suggest diplomatic heat is being brought to bear on the NZ inquiry. Andrea Hotere reports.

An American government department appears to be applying diplomatic pressure to the New Zealand police investigation into the mysterious death of an Australian scientist poisoned at the South Pole.

Police have said Dr Rodney Marks, a brilliant young astrophysicist who died in 2000 from a lethal dose of methanol, may have been murdered. They said suicide was "the least likely scenario" to explain his death.

But New Zealand investigators have been frustrated by a lack of co-operation from the National Science Foundation (NSF), the US body that runs the US Antarctic programme and for whom Marks, 32, worked.

The death is being investigated in New Zealand with the agreement of American and Australian authorities, and Christchurch coroner Richard McElrea has adjourned his inquest.

Documents obtained by the Sunday Star-Times under America's Freedom of Information Act include a letter sent last month by Christchurch investigating officer, detective senior sergeant Grant Wormald, to the NSF.

Wormald wrote: "I am aware that Mr Blum (actually Bloom) of the United States State Department has written to Mr Trevor Hughes from the New Zealand Ministry of Foreign Affairs and Trade (MFAT) questioning my perseverance in the conducting of this enquiry."

Wormald had earlier told the inquest into Marks' death that police had spent four years trying to get information from the American authorities that appeared to have investigated the death, but it was unclear how far their inquiries went.

No significant reports from NSF, or its contractor, Raytheon Polar Services, who ran the South Pole station, were available. Raytheon Polar Services is an offshoot of the multi-billion-dollar Raytheon Company Ltd, a US defence and aerospace systems supplier.

Any information would have helped police and consequently the coroner's inquiry, Wormald said.

Last week, Wormald would not comment on why he had written in those terms to NSF, but Green Party foreign affairs spokesman Keith Locke said the letter's content appeared to indicate diplomatic pressure.

He said whatever doubts American authorities had about jurisdiction issues, they had a moral obligation to "offer the fullest cooperation and encourage full investigation, especially when a person dies in strange circumstances".

MFAT's policy unit head Trevor Hughes said the letter expressed Wormald's interpretation, which he said was incorrect. Hughes said the NSF had done more than it was obliged to do to co-operate with the New Zealand police investigation; his legal advice was that the NSF only had to cooperate voluntarily.

The Freedom of Information Act documents add to the police's confusion about what investigations were done into Marks' death by the US organisations.

NSF spokesman Jeff Nesbit last week told the Star-Times that the NSF had not investigated Marks' death; the only investigation done was medical.

But a letter dated June 15, 2005, by Dr Karl Erb, Director of the Office of Polar Programmes, states: "A great deal of time and effort has gone into the analysis (of Marks' death)."

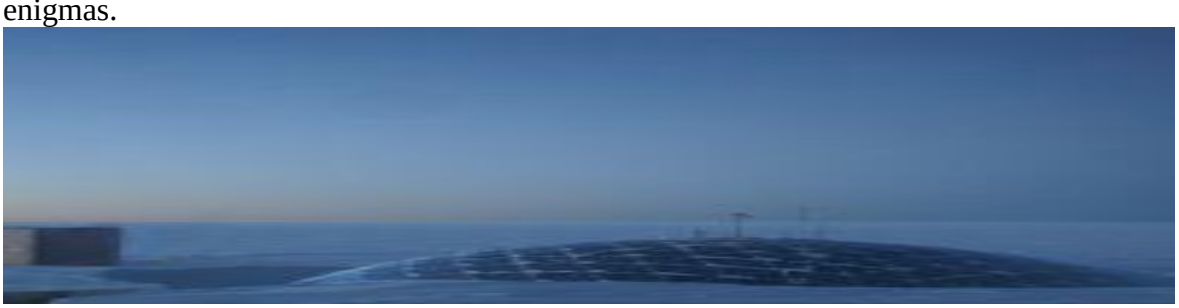
Another letter, dated December 1, 2006 from Wormald to the NSF, suggests his most recent inquiries from people at the station when Marks died revealed that all ethanol bottles and a still for producing alcohol of some sort had been found and repatriated to the US by the NSF.

The documents also include the police survey sent to the 50 people at the Pole when Marks died. It includes questions about intravenous drug use (at the inquest in December, it was reported Marks had three needle marks in his right arm) and drinking games at the station.

Nesbit said Raytheon Polar Services, as the NSF's contractor for Antarctic services, assumed all "audit, accounting and responsibility" and was responsible for medical care that Marks received.

...A Mysterious Death at the South Pole...

Fifty people. The most remote base on the planet. No way in or out for eight months. Then one of them dies under curious circumstances. A new look into one of Antarctica's most enduring enigmas.



Bottom of the World: The Dome at the Amundsen-Scott base, where Aussie scientist Rodney Marks died in 2000. Photo credit: Brien Barnett / National Science Foundation

During the 24 hours that Rodney Marks's life was slipping away from him, he had plenty of time to contemplate his predicament. He knew he was trapped, cut off from adequate medical attention, about as far from civilization as one can get on this planet. He knew that during the long, dark winters at the South Pole—where for eight months of the year it's too cold to land a plane—small problems become big ones very fast.

As the 32-year-old Australian astrophysicist lay on the old navy gurney in the biomed facility of the Amundsen-Scott base, Marks may have been thinking about the Russian doctor who had to give himself an appendectomy during a South Pole "winterover" in 1961, or of Dr. Jerri Nielsen, who in 1999 diagnosed and treated her own breast cancer with supplies dropped in by parachute. But unlike them, neither Marks nor the base's lone physician had any idea what was wrong with him. He had woken up at 5:30 that morning vomiting blood, and the burn that had started in the pit of his stomach was now radiating throughout his body.

It was already Marks's second visit to the makeshift hospital that day, and he arrived scared, anxious, and wearing sunglasses to protect his unbearably sensitive eyes. There was no one medical condition that the base physician, Dr. Robert Thompson, could think of that would explain what was happening to Marks. The doctor's only link to the outside world was an internet connection and a satellite phone, and both were down at the time — the base's position at the bottom of the planet meant it lost its signal for much of each day. The doctor spent hours clutching for a diagnosis, at one point grabbing hold of alcohol withdrawal and even anxiety as possibilities.

Thompson injected Marks with a sedative, which calmed him enough that he decided to return to his own bed and rest for a while. He lay beside his girlfriend, Sonja, sleepless and afraid, listening to the shifting ice groan beneath him. Then he retched again. More blood. His breathing was now uncontrollably fast. Pain throbbed in his joints, and he began to panic. He made his way

back to Biomed, this time stumbling through the dimly lit tunnels, disoriented, as if in fast motion.

By the time he arrived, he was hyperventilating and combative. Thompson gave him another injection — this time Haldol, a powerful antipsychotic — just to regain control of him. As it took effect, Marks lay down again, but this time he began to lose consciousness. He moaned quietly with each exhale and squeezed Sonja's hand lightly. Then his heart stopped.

A stationwide alarm summoned the trauma team, a few trained volunteers whose real jobs could be anything from scientist to mechanic. Darryn Schneider, a fellow physicist and the only other Australian at the base, was the first to arrive. He took over for Sonja, holding the ventilator mask over his good friend's nose and mouth, desperately pumping air into Marks's lungs.

Then, just before six in the evening, as the trauma team scrambled to save him and the rest of the 50-member crew were sitting down to dinner, Marks took a deep, sighing breath into his chest — it was his last. It was May 12, 2000, a full five months before a plane would be able to retrieve his body.

Once it was finally flown to Christchurch, New Zealand, that October, a startling discovery would be made, one that would set off an eight-year investigation and a bitter tug-of-war between a New Zealand detective and the National Science Foundation, which administers all U.S.-based research at the South Pole. The search for answers as to what killed Rodney Marks would also open a window into the highly peculiar, sometimes dysfunctional, community of people that operates in isolation there for eight months at a time. Ultimately, the NSF would make sweeping changes in how things are run at the South Pole and who it sends there.

At the time of Marks's death, though, there was little reason to anticipate such far-reaching ramifications. The rest of the crew assumed he had suffered a heart attack or aneurysm. The NSF itself even issued a statement within hours, saying he "apparently died of natural causes." But there was nothing natural about the way Rodney Marks died.

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Antarctica belongs to no one. seven countries officially have territorial claims on the continent, but the U.S. has never recognized any of them. Supported by a 1959 treaty of cooperation, 29 countries have set up scientific research stations there, and an ever-changing population of up to 4,500 scientists and support staff from all corners of the globe call it home for anywhere from four days to 14 months at a time.

Nearly all who come to work in Antarctica will first touch down in McMurdo, the continent's only working township. Resembling a small town in arctic Alaska, it sits at the edge of the ice, where it meets the Southern Ocean. Getting off the plane in Mac Town for the first time is a startling experience. The eight-hour flight from New Zealand aboard one of the cavernous military cargo planes leaves ears ringing and backsides numb. After landing, sensory overload gives way to the blinding absence of color and a Hoth-like landscape: a smoldering volcano in

one direction, the Royal Society range and Mount Discovery across McMurdo Sound, ice and snow everywhere.

Nearly a thousand miles from McMurdo, at 90 degrees south, just 100 yards or so from the always slightly moving geographic pole marker, sits the Amundsen-Scott research station, the loneliest habitation on Earth. Named for the first two explorers to reach the South Pole — separately in 1911 and 1912 — the American base is run by the National Science Foundation. In the mid-'50s, the intensifying Cold War goaded the United States into establishing a presence on the continent, so the navy announced it would build and man a permanent base at the South Pole. It launched Operation Deep Freeze in 1955, primarily as a research endeavor. The Dome, in which Marks lived, replaced the original station in 1975. It comprises three separate two-story structures that sit beneath an 18,000-square-foot, 50-foot-high geodesic shell, which acts as a giant windbreak, sheltering the living quarters from the deadly sting of the elements. The buildings themselves look like red portable sheds stacked on top of one another, each with a thick walk-in-freezer-style door.

Amundsen-Scott is populated year-round by scientists — most working for American universities and studying the atmosphere, astronomy, or seismology — and a support staff that includes everyone from cooks to carpenters. Nearly 250 people are based there in the summer, but the population shrinks to just a quarter of that for the austral winter: February through October.

The first week of February is frenzied as the remaining summer crew clears out and the winter crew receives its vital resupplies. The real cold arrives in March, and the base becomes a very different place: Soon the sun no longer makes it above the horizon, and it becomes so cold (temperatures regularly hit minus-80) that a plane's hydraulic fluids would freeze solid within minutes of touching down. After the last plane leaves, there's no way in or out for eight months, and the continent goes dark and quiet, just the way a winter Polie likes it.

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Understanding what type of person would volunteer to work at the South Pole during the winter is something that has intrigued everyone from social scientists to NASA. The physical screening is rigorous — it's often said that everyone handed a winter contract has perfect wisdom teeth, and some bases won't even consider you if you have an appendix — but psychological screening is far less straightforward. Through a series of tests and interviews, the NSF tries to hire people with a rare and delicate balance of good social skills and an antisocial disposition — basically, loners with very long fuses.

Some of the first behavioral studies on the South Pole winterover were launched after the sudden onset of schizophrenia in a construction worker in 1957. He had to be sedated and quarantined for almost an entire winter. Lore has it he was put in an improvised mental ward — a specially built room padded with mattresses. Because incidents like these can spiral out of control quickly this far from civilization, putting entire crews at risk, NASA saw a South Pole winter deployment as an interesting analogue to long stays in space.

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A week before he died, Marks played at a Cinco de Mayo event on base.

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“We’re social animals,” says Lawrence Palinkas, professor of social policy and health at the University of Southern California and the author of several behavioral studies on social dynamics in Antarctica on behalf of NASA. “The separation from friends and family is stressful. But the lack of stimulation — of new scenery, new faces — actually causes people to have difficulty with cognitive thought. Even in well-adjusted groups, we estimate between 3 and 5 percent will experience some form of psychological problem — sleep disorders, depression, alcohol addiction.”

It’s this ability, even willingness, to live in such extreme conditions for such an extended period of time that sets winter Polies apart. They have an odd sense of adventure and actually seem drawn to the isolation and risk. “These are people who thrive on being the last cog,” says Harry Mahar, health and safety officer for the NSF’s polar program from 1992 to 2004. The power plant technicians, for instance, “are the type of people who, in their off year, would run DEW line sites [for distant early warning of missiles] up in the Arctic or power plants in the middle of

the Pacific, and they're damn good mechanics." That's a good thing: If the generators at the South Pole go down and can't be fixed, the crew probably won't survive.

Rodney Marks was a typical Polie in both his proficiency and his quiet confidence. "Brilliant" is a word colleagues often use to describe him. His aptitude for science was obvious at an early age when he landed a scholarship at a prestigious private school in his hometown of Geelong on Australia's southern coast. (He spent his free time as a youth surfing and rooting for his local Aussie rules football team.) He discovered astronomy at the University of Melbourne, and a Ph.D. in physics soon followed, as did a number of high-profile fellowships and research positions with Australian and American universities. Meanwhile, music had also become a big part of his life, and he eventually formed a band called the Changelings, with a nod to the guitar-driven prog rock of the early '90s. He practically lived in his green Sonic Youth T-shirt.

In 1993, at age 24, Marks approached one of his professors looking for an "interesting" Ph.D. project and learned of a South Pole study being conducted in collaboration with the University of Nice. A few months later he had become fluent in French, and a year and a half after that he stepped out onto the ice at the South Pole for the first time, for a two-week stint. Marks's specialty was radio astronomy, a highly accurate method of viewing the cosmos that relies on capturing the radio waves that objects in space transmit. Antarctic winters provide ideal conditions for the telescopes that are used, which operate best in the stability of a very cold atmosphere. In 1997, he reported for duty for his first winterover in Antarctica, an experience he enjoyed so much he signed up again just two years later.

Before the start of every winter, the NSF sponsors a staff training. It's a typical team-building retreat, with a ropes course, trust falls, and enthusiastic "facilitators," but it also serves as the first step in weeding out people who might not cope in such close quarters and so far away from home. It was at the 1999 retreat in the rocky hills above Boulder, Colorado, that Marks first met the other people with whom he'd be spending the 2000 winter. He was one of several returning winter crew, and he preferred dispensing advice to newbies during smoke breaks to sitting in a classroom talking about his hopes and fears for the season.

Six-foot-two with long, sometimes dreadlocked hair, Marks stood out from the other scientists physically, but also in the way he was able to mingle effortlessly between competing personalities. He was slightly self-conscious about his mild case of Tourette's syndrome, though it was hardly noticeable to others — some twitching, a sharp clearing of the sinuses from time to time.

This was the first year that the NSF handed all operational duties at the base to Raytheon Polar Services, a Colorado-based division of the defense contractor. For the training, Raytheon used a company whose staff was experienced in working with police and fire departments, specializing in high-stress group dynamics. They were used to dealing with people who had a healthy respect for authority; the winter Polies were different. During the two-day session, they questioned every nuance of every exercise and flat-out refused the trust falls, claiming they were sure their colleagues would *not* catch them.

On the last day of the retreat, one of the facilitators pulled aside Darryn Schneider, Marks's fellow Aussie physicist. "You know, you guys are one of the most screwed-up groups of people I've ever come across," he told Schneider. "We work with SWAT teams, and you guys just made them look touchy-feely and friendly. There's no way you'll ever function as a group."

"That's exactly why we *will* function," Schneider shot back. He too already had one winter on his résumé and knew that social survival at the South Pole went against all conventional wisdom: Problems are not swept under the rug; they are placed under it very deliberately. It's the art of containment, rather than resolution, that gets Polies through the eight-month-long night.

But Polies also have quite a bit of help in this department: alcohol. With not much else to do, social life at Amundsen-Scott, particularly during winter, revolves around drinking. Everything from beer to tequila is brought in alongside vital scientific resupplies at the start of the winter, and it's said that every year at least one belligerent alcoholic emerges on base. In 1996 a worker was thrown into detox three times before he was finally forced to live in the medical facility, isolated from the rest of the population. The next year, there was such a booze shortage that the staff wound up giving each other beer as Christmas presents. In 2000 one staffer was rumored to have racked up a $10,000 bar tab. The Dome even had its own moonshine still that got inherited from one crew to the next.

The beating heart of the base was the bar, 90 South. There, the staff drank and danced until all hours of the night, underneath the colored Christmas lights and disco ball. Graveyard crews would roll in at eight in the morning, post up on the bar stools, and do shots to wind down before going to bed. Over the years the bar had accumulated decades' worth of oddities — stuffed penguins, neon signs, dozens of cabin-fever escape paperbacks. It was the one place on the base where Polies could forget where they were.

When Marks and Schneider finally arrived at the Dome in November 1999, the start of what was supposed to be a yearlong stretch, they quickly claimed their stools at 90 South. Like most of the others, Marks was a drinker. He was always up for a night at the bar, and he wasn't afraid to sneak a bit of "toast juice," the high-octane ethanol-based concoction produced by the still. Sometimes he drank just to suppress his Tourette's.

When not in 90 South, Marks could usually be found in the attached galley, at one of the tables near the "dish pit." Or, during special occasions, on a small stage in the corner, playing his beat-up Gibson guitar, belting out a cover with his South Pole band, Fanny Pack and the Big Nancy Boys. His girlfriend, Sonja Wolter, 33 at the time, played bass. The two fell in love during the summer-winter transition, just as she was about to be shipped out at the end of her contract. They wanted to stay together so badly that she quickly applied for a winter position and was accepted just a week before the last plane out. For the start of the winter, he had dyed his hair purple, and she had dyed hers green. A few months later they were engaged. It was common for Polies to take an "ice wife" just for the winter, but this was different. By all accounts Rodney and Sonja were soul mates.

The base is normally a brutally cliquey place, and crews tend to segregate into three separate populations — scientists; operations (those responsible for the day-to-day running of the base);

and skilled laborers. But the winter crew of 2000 was unusually tight-knit; migrating from one group to another didn't provoke the sort of contempt it had in years past. Marks, in particular, had a knack for making others feel at ease. "He had a Ph.D.," remembers Gene Davidson, a Kiwi responsible for telescope maintenance that winter, "and yet he would play poker, smoke cigarettes, and drink whiskey with the carpenters and plumbers."

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South Pole astronomers have the coldest commute on the planet. The observatory where they work is a full kilometer from the main station, in an area officially known as the Dark Sector. Like most base astronomers, Marks would bundle up and make the round-trip on foot every day.

He worked for a program for the Smithsonian called AST/RO (Antarctic Submillimeter Telescope and Remote Observatory) and spent most of his time collecting data on how to further improve viewing conditions using an enormous infrared telescope. His work was highly regarded, and he was making profound breakthroughs in the way we view the cosmos from Earth. On Tuesdays, he held an astronomy class for his fellow Polies, sometimes taking everyone outside and introducing them to a night sky he knew intimately. Colleagues described him as having a combination of wildness, imagination, and dedicated self-discipline that makes for great science.

It was during the walk home from the observatory one Thursday night in May that Marks first sensed there was something wrong with him. At about 6:30 he and Sonja arrived in the galley, where he ate a light meal and drank a can of beer. He mentioned to her that he wasn't feeling well and that he was having trouble seeing clearly. By 9:30 he had retired to the room they shared and fell asleep. That night in the galley was the last time most of the winter crew would ever see Marks alive. He would spend the next 21 hours fighting for his life.

Schneider's blog entry for friends and family back home, written the following night, after he had spent nearly an hour trying to save his closest friend on base, would read: "We did everything we could, but Rodney did not come back. He had friends around him at the end. We have no idea what happened."

While Schneider and others tried to douse the embers of the day's events at the bar, Marks's remains were placed in a body bag and stored in a service area known as the fuel arches, connected to the main station through one of the tunnels. The ambient temperatures there were plenty cold to preserve the corpse, but his friends felt he deserved a more dignified resting place. Like the explorers that came before them, they considered their work heroic, and Marks was one of the best South Pole scientists they'd ever known.

The station carpenters found and milled an old stash of heavy oak for a casket, and the machinist crafted the metal fittings. Schneider and one of the cooks upholstered the interior with an old tablecloth, and Sonja made a maple plaque with a brass inlay of Marks's favorite constellation, Scorpio. Once finished, they placed his body in the casket, then used a traditional wooden Nansen sled to haul it out to the geographic South Pole for a quiet ceremony. It was a Sunday afternoon, and the entire crew gathered under an ink-black sky as someone read a statement from

Marks's mother and friends said a few words. Marks was then lowered five feet deep into the ice.

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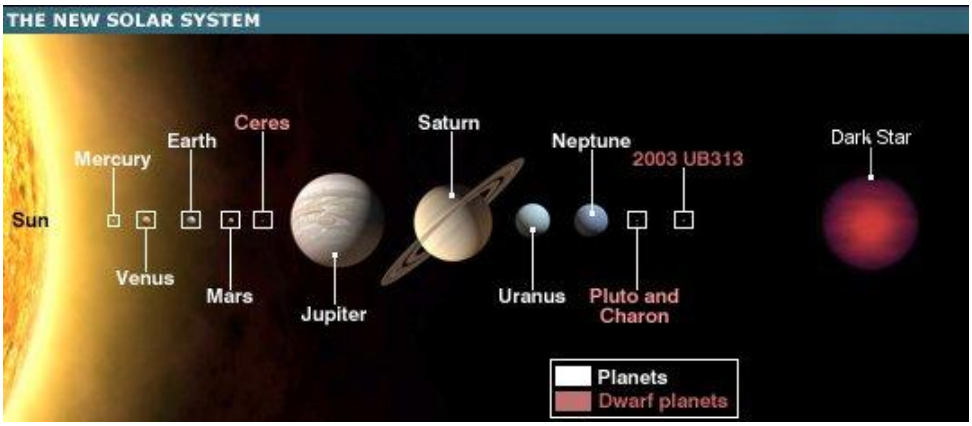
New Zealand is Antarctica's nearest neighbor. It's so close, in fact, that when icebergs recently calved off the Ross Ice Shelf, Kiwis were flying out in helicopters and landing on them. Christchurch, on the South Island, is a small coastal city of about 400,000, but its population swells slightly every spring as people from all over the world pass through on their way to Antarctica, and then again in the fall as they return to catch commercial flights back to their home countries. Murder rates are low, and veteran detective Grant Wormald, 44, spends most of his time overseeing theft and fraud investigations. As a young man, Wormald was given an opportunity to work as a station manager in Antarctica but had to pass it up when career and family obligations got in the way. "It was something that appealed to me," he says. "I hear it's surreal — like going to church in a big way."

In June 2000, four months before flights in and out of Antarctica would resume, Wormald's office received a curious fax from the local coroner: an order to begin investigating the death of an Australian citizen stationed at an American base in Antarctica. Marks's case was fraught with jurisdictional ambiguity, but New Zealand law states that the coroner is entitled to hold an inquest on the basis of a body simply being present in the country, and Christchurch was certain to be the first place Marks's body would land. Jurisdiction would soon become the least confusing thing about Marks's death.



Anywhere else in the world, following the unexplained death of someone so young and healthy, Marks's office and sleeping quarters would have been cordoned off and preserved for investigation. And although Raytheon, the facility management company, is reported to have requested this, its authority was simply too remote to impress upon the grief-stricken crew, who felt sure Marks had died of natural causes. A few items were collected from his office and bedroom and put aside, but anything that didn't look suspect went straight into the garbage. After being cleaned up, both areas continued to be used just as they had been before his death: his office by other scientists, and his room by Sonja, who lived there for the rest of the winter.

At around midnight on October 30, the first plane off the ice landed in Christchurch carrying Marks's casket. Also aboard were Darryn Schneider and Sonja, who wearily made their way to a hotel where Marks's mother, Rae, and his two sisters were waiting to meet them. The five eventually moved across the street to Bailies, a Polie hangout where both Shackleton and Scott once drank and where more people who had worked with Marks showed up. The impromptu wake carried on well into the following morning.

Along with a few others from the base, Schneider stayed in Christchurch just long enough to talk to police, but without any autopsy results yet, it was largely fruitless testimony. Had they known what the autopsy would reveal, they probably would have stuck around, if not been required to.

Six weeks later, on December 19, the forensic pathologist made a shocking announcement: Rodney Marks had been poisoned. His blood contained lethal traces of methanol, a highly toxic wood-alcohol-based chemical Marks used to clean the high-tech telescopes, but in amounts far beyond what would be expected with normal contact — about a small wineglass's worth. It was, the pathologist believed, "virtually certain to have been ingested."

The news was all the more tragic because of testimony that base physician Robert Thompson had given a month earlier. He had revealed that while Marks lay dying, his potential lifeline was sitting dormant in a corner of the room — an Ektachem blood analyzer. Its single, tiny lithium-ion battery had died, and therefore, the machine lost its calibration every time it was turned off. Once turned back on, it took up to nine hours to recalibrate. Thompson had known about the malfunction, even reported it to Raytheon, but for some reason never attempted to fix it and decided against simply leaving it on. It was by no means a necessary piece of equipment in the physiday-to-day duties, but it was there for a reason: emergencies just like this one.

A working Ektachem machine would have recognized an abnormal anion gap in Marks's blood, the causes for which make up a fairly short list, including methanol poisoning. Had his condition been caught in time, reversing the effects could have been a simple matter of running a mixture of ethanol and saline through his body. Even if it hadn't saved his life, it would have immediately raised the question of how methanol could have possibly gotten into his system.

—-

"Murder at the South Pole" is the kind of headline that newspapers can't resist. Shortly after the pathology report was released, Wormald made a short, simple statement about what he and the coroner knew so far. Like any good detective, he wasn't prepared to rule anything out so early in the investigation, including homicide, and the media pounced.

"Common sense told us there were only four possibilities as to how Rodney came to ingest the methanol," Wormald explains. "One, that he drank it willingly and knowingly with the intention of getting a high; two, that he took it to end his life; three, that he took it accidentally; and finally, that someone had spiked his drink, possibly as a prank or even knowing that it would either make him very ill or kill him."

Considering what Marks had going for him when he died — a fiancée, a sterling reputation among his colleagues, and a bright future — suicide was ruled out almost immediately. And for those who knew Marks, it was equally inconceivable that one of his fellow Polies would intentionally do him any harm. “I never noticed anyone acting differently afterward,” says telescope mechanic Davidson. “And I can’t think of anyone who would have disliked Rodney that much or had anything against him, or even had anything to gain by it.” It was looking more and more likely that someone had simply made a tragic mistake, but who, and how?

Wormald would eventually learn that Marks’s work space was notoriously messy; bottles of lab agents like methanol and ethanol were often strewn about alongside a dozen or so empty bottles of alcohol. The methanol used at the South Pole is similar to a car’s windshield-wiper fluid, while the less toxic ethanol, a common ingredient in the base’s homemade moonshine, is more like rubbing alcohol. Both are colorless and nearly as odorless as vodka and almost indistinguishable from one another in taste. Mistaking the two was certainly a possibility, especially by someone under the influence of alcohol.

But it’s unlikely that person would have been Marks. He certainly knew how lethal it was and that ingesting even a small amount could be fatal.

“I’ve gone over it many times in my mind,” says Davidson. “He was too smart to drink it knowingly. If anything, maybe someone else didn’t know the difference between methanol and ethanol and put the wrong thing in his drink, saying, ‘Here, drink this. It’ll give you a good buzz.’ I always come back to the idea he was slipped it, and maybe the person didn’t even know it.” Wormald agrees: “Rodney was lucid for 36 hours before he died. If he had known what was ailing him, he would have told somebody.”

Given the contained nature of the incident and the fact that he had a finite list of witnesses, Wormald was feeling optimistic about his investigation. But then he hit a brick wall with the NSF.

In 2002, Wormald made a formal request for the contact information of the 2000 winter crew along with any other facts the NSF had gathered during its own investigation. He got no immediate response. (Eventually, the NSF declined, citing privacy concerns.) He requested the results of lab tests done on what little evidence was collected in Marks’s room and work area. Nothing.

He was puzzled by the lack of cooperation but had no authority to compel the NSF to comply. “Had there been evidence of a criminal act, things would have been very different,” he says. “The FBI would have been flown in, maybe even the Australian police.” But although Wormald hadn’t ruled out manslaughter or even homicide, he simply didn’t have enough evidence of foul play to justify classifying the case as such. Wormald’s investigation came to a near standstill as almost every request he made was met with silence.

Even before Marks’s death, the NSF was under pressure to update its outmoded base. It knew it had issues with drinking among its Polies. Now, with news of an inoperable Ektachem machine

and the fact that a wood-alcohol-based chemical killed Marks, it had a potential PR crisis on its hands. The organization seemed to be in lockdown.

Over the next four years, Wormald persisted with his own investigation as the NSF and Raytheon drip-fed him information, including the fact that the moonshine tested negative for methanol. But little else shed new light on the case. The NSF also never announced the results of its own investigation, effectively absolving itself of any culpability in the matter. The agency appeared ready to move on.

But Wormald wasn't. "I'd like to think that if my children went to work down there and something went wrong, someone would be responsible for finding out what happened," he says. "I know Rodney's family wants to know why the machinery that would have diagnosed his illness wasn't working and whether anyone will actually be held accountable — whether anyone even gives a shit. Someone should be required to give a damn."

Finally, in 2005, the NSF agreed to forward questionnaires to the remaining 49 members of the 2000 winter crew on Wormald's behalf. He got just 13 back and remains convinced that the pressure of losing future employment was simply too great for the rest of the crew. But Polies are also notoriously transient and hard to track down. Also, they were as eager as the NSF to put the incident behind them, accepting it as a freak, tragic mistake. Even those closest to Marks, including his fiancée, Sonja, decided early on that to keep chasing answers was to degrade the memory of their friend.

In September of last year the official findings from the coroner, based largely on Wormald's investigation, were finally released. The 50-page report is little more than a neatly packaged catalog of theories and speculation, concluding that "Rodney David Marks died as a result of acute methanol poisoning, probably occurring one or two days earlier, he being either unaware of the overdose or not understanding the possible complications of it."

But buried in that report is a detail that has gone largely overlooked throughout the investigation — a detail that points to what may be the most compelling theory yet as to how Rodney Marks was poisoned.

The revelation is made in a section of testimony by Harry Mahar, South Pole health and safety officer at the time. Mahar mentioned to investigators "an unusual-shaped bottle of liquor" he'd heard that Marks had brought back to base from an R&R trip to New Zealand just before the start of winter.

Schneider remembers the bottle too, and says it was among several empty ones found behind Marks's computer after his death. He recalls it had an exotic-looking black-and-white label with writing in Portuguese or a similar language and a picture of a shrimp. He believes it was thrown away with the other bottles.

One Polie who remembers the bottle but wishes to remain anonymous says that as soon as he learned Marks had been poisoned, it hit him that this bottle could have played a role. He had a theory, and he shared it at the time with a fellow crew member and investigators, but it was roundly dismissed as wild speculation. The Polie explained it in an e-mail to *Men's Journal*:

In certain parts of the world, he wrote, "people are aware of the dangers of tainted alcohol from places like Southeast Asia. There are regular warnings for travelers." He included a link to a Lonely Planet travel forum from this June: "Deadly Brew Kills Foreigners in Bali" was the headline. That, in turn, linked to a report of 23 people dying after drinking a local palm liquor that had been spiked with methanol to increase its potency.

Turns out, every year there are hundreds of similar cases, everywhere from Southeast Asia to Africa to the Himalayas. Just last May, an almost identical story made its way out of Everest base camp when a popular Sherpa died after drinking methanol-tainted whiskey. The World Health Organization reports as many as 300 deaths per year relating to the "lack of quality controls, especially in the preparation of illicit liquor." All of these deaths are the result of acute methanol poisoning.

Detective Wormald says the bottle was "not ruled out as a possible source." He even asked about it on the questionnaire he sent out to crew members — a handful of Polies acknowledged its existence in their responses — but he says "no identification of source [of the bottle] was made."

The anonymous Polie is quick to admit that even he feels that his theory is "out there," but that it was essentially the only wild card he could think of. He still doesn't understand why it wasn't pursued more vigorously, even if just to rule it out. He went as far as forwarding to investigators the names and contact information of some of Marks's friends back home who he thought might be able to help pinpoint the bottle's origin. "I felt like I was being accused of making stuff up," he explains. "I don't think they followed up with any of the individuals I suggested. I was essentially told to forget about it."

And so he did. But if he's right about his theory, it points to a great potential irony: that not one drop of the methanol that killed Marks came from the gallons of it that surrounded him at Amundsen-Scott.

Had that one bottle made it off the ice in one piece and been tested, or even if investigators were able to determine where it had come from, we might know for sure how Rodney Marks died.

—-

Last year Darryn Schneider flew to Antarctica for what would be his 10th deployment. It was a straightforward four-month summer stay, but these days, trips to the pole are bittersweet for him. The old Dome that he called home for a cumulative two years of his life has since been repurposed as vehicle and refuse storage. The South Pole he remembers has all but disappeared.

January 2008 was the ceremonial opening of Amundsen-Scott's third and latest incarnation, a striking outcrop of steel and glass, perched on stilts 12 feet above the ice. It's three and a half times the size of the Dome, which is now nearly buried under 34 years' worth of spindrift. The new 65,000-square-foot facility cost $150 million to build and required nearly a thousand cargo planes full of materials. It's an engineering achievement: Its stilts can be jacked up as snow accumulates below the structure, and the two units of the main building can move independently as the ice shifts in different directions beneath their feet. It towers above the old Dome like an enormous gravestone.

These days Schneider finds himself wandering its cavernous hallways feeling a bit lost. Even though he has spent four seasons at the new base, which became partially operational in 2004, he misses the "old pole" and the old way of doing things. "One of the observatories where Rodney and I worked was just shut down last month," he said earlier this year, while still on base. "Rodney's death also had an influence on getting rid of the old biomed facility, but the real turning point was when they finally got rid of the bar. The NSF did not like the culture of 90 South." A new bar was built, but after it became illegal to smoke in a government building, it was converted into a TV lounge. "This was a place that was supposed to replace the old 90 South, and now it's a place where people do Pilates," Schneider says. There's no more moonshine still either. The NSF hauled it out onto the open ice and made a show of running it over with a tractor.

Schneider says things have been slowly changing for a decade now, and old-school Polies like him are an endangered species. He was puzzled by the introduction of a follow-up psych test, mostly dealing with addiction and mostly handed to those who spent time in 90 South. He also

began to notice that fellow veterans were no longer being asked back in favor of more rule-abiding new blood.

“The government just underestimates the importance of the culture,” Schneider says. “It’s strange, you would think they would keep some of these old-timers around because of their institutional knowledge. Tradition used to mean a lot down there.”

Despite the changes, there’s one tradition Schneider refuses to let die: a living memory of his good friend Rodney Marks. After the winter crew of 2000 buried him in the ice, they planted an Australian flag over his grave, a temporary marker to help them find the casket again at the end of the season. When his body was flown back to Christchurch, a flag was all that remained at the South Pole to mark the tragedy. Schneider decided it should stay. Since then, each time he returns to Amundsen-Scott he removes the old, brittle, sun-baked piece of cloth and replaces it with a new one. For nearly 10 years now, he and three of Marks’s other close friends have acted as unofficial stewards, making sure there’s always a Commonwealth Star waving at Marks’s last resting place in Antarctica.

“The NSF hates it and continually fights to get rid of it,” says Schneider. “I guess they don’t want there to be a reminder of the incident. But I want that flag there, and Rodney’s family likes the fact that that point in the ice is marked. The fact that the flag moves farther away from the base each year, as the ice moves, is a very graphic reminder of the passage of time since this terrible event in our lives. At some point it might die, but the ephemeral nature of it makes it a powerful memorial.”

With or without the flag, it’s doubtful anyone will ever forget the curious death of the South Pole scientist in the winter of 2000. One crew member’s blog from 2006 says it’s now lore that the fuel arches are haunted by Marks’s ghost; as recently as 2004, Schneider overheard some Polies who never even knew Marks talking about his “murder.” “People love putting rumors out there, and South Pole stories become mythical,” he says.

Ultimately, Rodney Marks may have simply slipped through the cracks — disowned by the NSF for the sake of its reputation; overlooked by his native Australia; left to rest in peace without resolution by a coroner and a detective exhausted by an eight-year battle with the NSF; nothing more than a stark reminder to his fellow Polies that at the South Pole, shit happens.

Polies have a saying: “What happens on the ice stays on the ice,” and, to them, to try to help outsiders understand what life is like there is an antithesis to why one goes there in the first place. Perhaps Rodney Marks himself would be perfectly happy remaining one of the South Pole’s great enduring mysteries.

...Professor Dr. Richard Crowe, 60 years old...

Died May 27th 2012 in an off-road accident in Arizona. Dr. Crowe came to UH Hilo 25 years ago and helped launch the University's undergraduate astronomy program. is numerous publications and co-authored works added significantly to the body of astronomical literature. He regularly trained UHH student observers with the UH 24-inch telescope on Mauna Kea, and conducted many research programs on that telescope. In 2005, he won the AstroDay Excellence in Teaching Award for his efforts. In 1991, Dr. Crowe was selected as a Fujio Matsuda Research Fellow for his scholarly work on pulsating variable stars. Crowe was also active in the community. He was a longtime member of the Rotary Club of Hilo Bay.

U of Hawaii Astronomer, Dr. Richard Crowe Killed in an off-road accident over the Weekend - Another one

The University of Hawai`i at Hilo is mourning the loss of one of its own. Astronomy Professor Dr. Richard Crowe was fatally injured Sunday afternoon in an off-road accident in Arizona.

Dr. Crowe came to UH Hilo 25 years ago and helped launch the University's undergraduate astronomy program. Crowe was also active in the community. He was a longtime member of the Rotary Club of Hilo Bay, where he served a term as President. Crowe is survived by his wife and two children.

He was 60 years old.

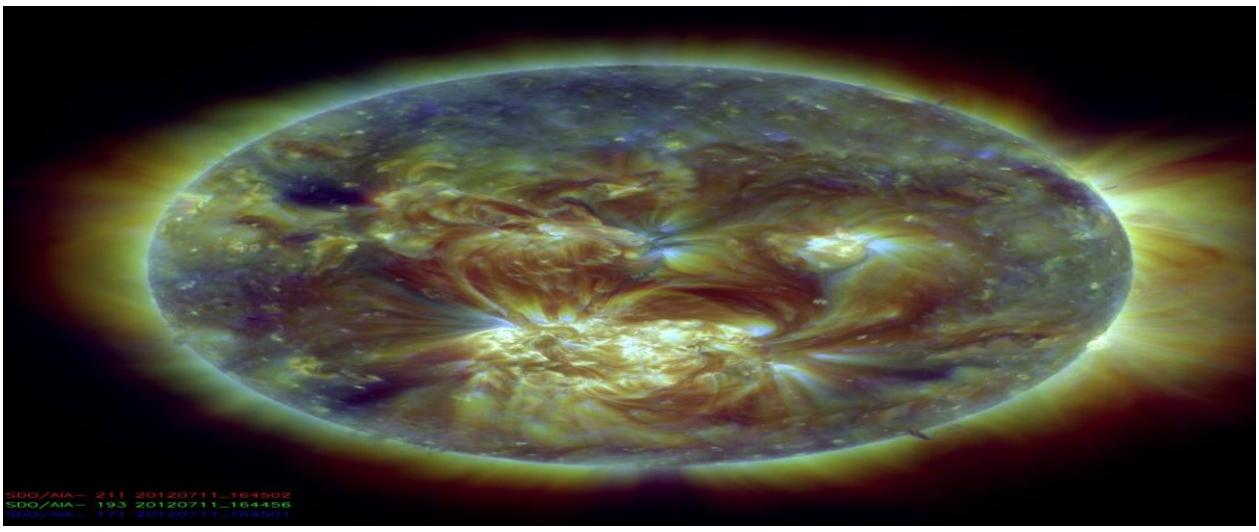
http://www.kpua.net/news.php?id=25407

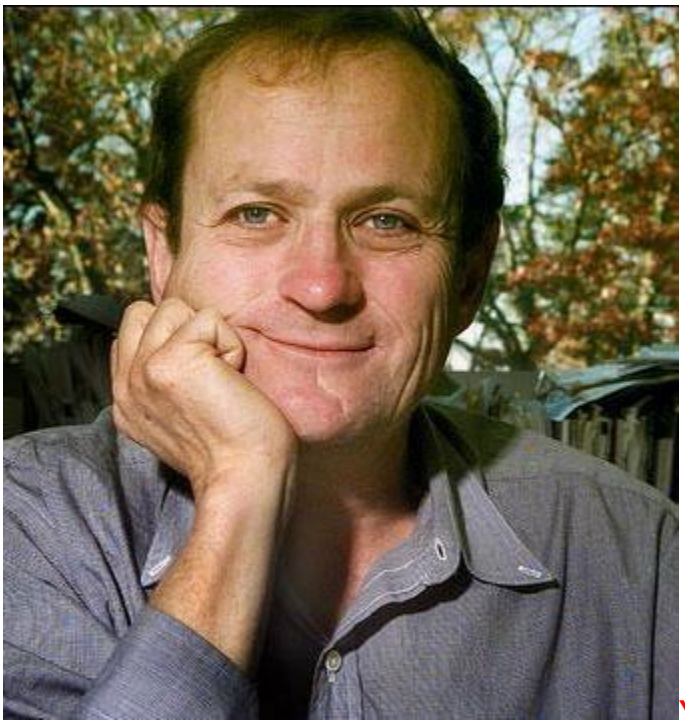
UHH astronomy professor dies in rollover Jeep crash

Richard Crowe, co-founder of the University of Hawaii at Hilo's astronomy program and astronomer-in-residence at 'Imiloa Astronomy Center of Hawaii, was killed Sunday in a bizarre Jeep accident near Chinle, Ariz. He was 60.
http://www.hawaiitribune-herald.com/sections/news/local-news/uhh-astronomy-professor-dies-rollover-jeep-crash.html

Dr. Crowe's main research interests are pulsating stars, stellar evolution and spectroscopy. He is a co-author on 47 scientific publications (16 first author), 25 of them major ones listed in the Web of Science, with a Hirsch citation index of 13. Dr. Crowe has also authored 9 articles, 2 of them major ones listed in the Web of Science, that critique astrology, UFOlogy, Mars "face" claims, and creationism. In 1991, Dr. Crowe was selected as a Fujio Matsuda Research Fellow by a University-wide committee for his scholarly work on pulsating variable stars. He regularly trained UHH student observers with the UH 24-inch telescope on Mauna Kea, and conducted many research programs on that telescope. In 2005, he won the AstroDay Excellence in Teaching Award for his efforts.

Dr. Crowe served as Chair for the Department of Physics and Astronomy from 1992-2002, and has been a member of the UHH Sigma Xi Chapter since 1990. For its activities while he was Chapter President in 1991-92, the UHH Sigma Xi Chapter was awarded the prestigious Certificate of Excellence by a National Committee. He also represented UHH at the 1991 Sigma Xi Forum on Global Change and the Human Prospect held in Washington, D.C., at the 1996 Sigma Xi Forum on Science, Technology and the Global Society held in San Diego, and at the 1999 Sigma Xi Forum on Reshaping Undergraduate Science Education held in Minneapolis. Dr. Crowe has delivered many public and school lectures on the subject of astronomy. He is a co-team leader on the Journey Through the Universe program, and he has been active in publicly promoting science education and critical thinking, having written 18 Hawai'i newspaper articles on these subjects.





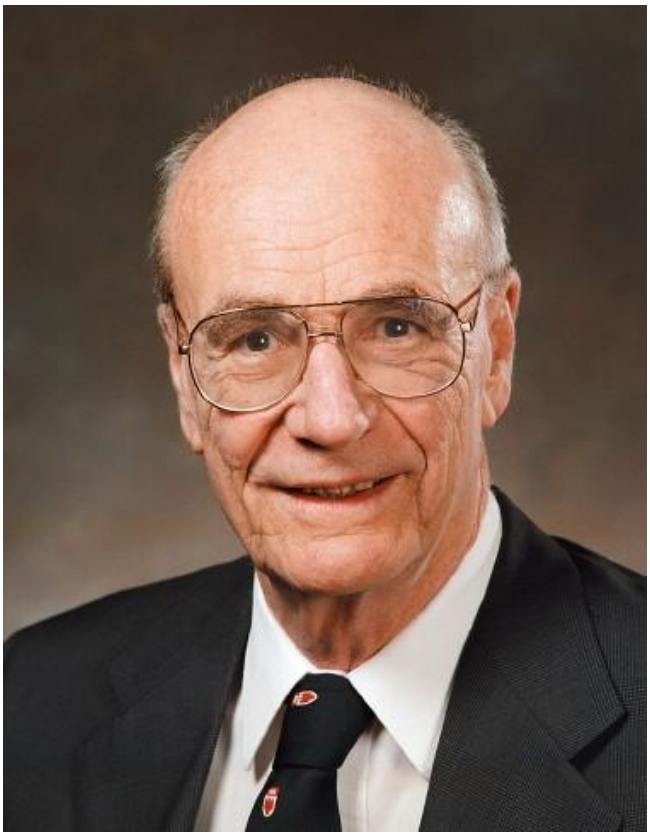
Yoram Kaufman, age 57 (one day before his 58th birthday). Died: May 31, 2006 when he was struck by an automobile while riding his bicycle near the Goddard center's campus in Greenbelt. Dr. Kaufman began working at the space flight center in 1979 and spent his entire career there as a research scientist. His primary fields were meteorology and climate change, with a specialty in analyzing aerosols -- airborne solid and liquid particles in the atmosphere. In recent years, he was senior atmospheric scientist in the Earth-Sun Exploration Division and played a key role in the development of NASA's Terra satellite, which collects data about the atmosphere

...Dead astronomers in France...

Three killed in NASA van plunge [Dec 8] 'A commuter van from NASA's Jet Propulsion Laboratory tumbled 200 feet off a twisting mountain. The van was carrying six employees of the lab in Pasadena, two contractors and two NASA employees. The cause of the accident was not immediately known. Clouds and fog shrouded the site, at an altitude of about 1,500 feet. Snow dotted flanks of the mountain, but the road itself was clear.' [and from another source] The Angeles Crest Highway is a two-lane road, with many sharp curves and very steep drop-offs (although there are guardrails). There is an observatory, Mt. Wilson, up at

the top. [and from another source] There have been quite a few scientist killed over the last 10 years. In fact the odds of so many of them being killed by accident within such a small time frame is extremely remote. [and from another source] French cable car crash kills 20 [Jul 1, 1999] 'The car detached itself from the cable, but the cable did not snap. Most of the victims were reported to be employees of the observatory, which is run by French, German and Spanish scientists. The cable car was used only for the observatory and no tourists were believed to be on board. The chief representative of the cable car union said the cable car was built in the 1980s and had recently passed a safety inspection.'

...Astronomer Don Osterbrock Dead...



Donald E. Osterbrock (1924–2007).
UC Santa CruzDonald E. Osterbrock, one of the leading American astronomers and astronomical historians of the 20th century, died on January 11, 2007, at age 82.

Osterbrock was a professor emeritus of astronomy and astrophysics at the University of California, Santa Cruz. Although he officially retired in 1992, he was still working on many projects and mentoring graduate students. He suffered a massive heart attack while walking across the university campus last Thursday. His death comes as a complete surprise and great shock to his family and friends.

Brian Geoffrey Marsden

was born on August 5, 1937, it died on November 18, 2010. He was an astronomer américano-British; he was since 1978 the director of Minor Planet Center of the SAO located at Cambridge in Massachusetts. Minor Planet Center, under the auspices of the International Astronomical Union, it is the official organization in charge of the data-gathering of observation for small planets (asteroids) and comets, the calculation of their orbit and the publication of this information via Minor Planet Circulars…

Al Rex Sandage was born on June 18, 1926 in Iowa city, Iowa (the United States), and died in San Gabriel (California) on November 13, 2010; it counted among the largest contemporary American astronomers. Born in an Jewish family, it converts towards the end of its life to Christianity. Sandage worked at the observatory of the Palomar Mount. This observatory belongs and is controlled by California Institue off technology (Caltech). One of the important programs allotted to the Palomar mount is the research program of comets and the asteroids géocroiseurs called Near Earth Asteroid Tracking (NEAT). the asteroids géocroiseurs are asteroids evolving/moving in the vicinity or in direction of the Earth. To name them one often uses abbreviation ECA, of English Earth-Crossing Asteroids, asteroids whose orbit crosses that of the Earth. Some of these objects being likely to run up against the Earth, they are the subject of a research and a particular follow-up…

The two men died of an acute encephalomyelitis. Disseminated acute encephalomyelitis or encéphalite post-infectious or encéphalite périveineuse are an inflammatory disease démyélinisante central nervous system. It is usually secondary with a viral, bacterial infection or with a vaccination but can also appear spontaneously. It consists of an auto-immune ignition leading to the destruction of the sheaths of myéline in the substance white, and present in this respect similarities (physiopathological, clinical and paraclinic) with the pushes of multiple sclerosis. It is a rare disease whose incidence is worth 0,8 cas/100 000 personnes/an and who preferentially touches the child and the teenager, the majority of the case occurring between 5 and 8 years. This fulgurating disease perhaps inoculated by means of an aerosol, very often arms used by the CIA.

The two astronomers died at 5 days of interval of the same disease, and which

more is of an extremely rare disease. They were specialized in the observation and the research of comets. Death threats by the US government nothing to reveal on their discoveries concerning the trajectory and the real size of the comet Elenin, they persisted in wanting to reveal the facts with the general public but in vain. A few weeks later, the trajectory which is given officially to the general public by NASA will be obviously false. Work of Marsden and Sandage showed a proximity too much important. The consequences would be a bursting of the earth's crust on the totality of the sphere. A true cataclysm. Half of humanity will be decimated.

...David Norman Schramm...

(25 October 1945 – 19 December 1997) was an American astrophysicist and educator, and one of the world's foremost experts on the Big Bang theory. Schramm was a pioneer in the study of Big Bang nucleosynthesis and its use as a probe of dark matter (both baryonic and non-baryonic) and of neutrinos. He also made important contributions to the study of cosmic rays, supernova explosions, and heavy-element nucleosynthesis.

Most of the accidents I hear about have to do with the hazards of traveling to and from

observatories and conferences. A recent tragic accident was the death of Prof. David Schramm, a world renound University of Chicago physicist and cosmologist. He died in a private plane accident.

A decade ago, an astronomer died at an observatory when a special set of interlock doors in the observatory dome failed to operate properly and he was crushed to death between the inside and outside walls of the rotating observatory dome at Kitt Peak

...Brewster Shaw...

On July 3, 1997, the son of a high-ranking NASA shuttle chief, named **Brewster Shaw**, from Houston, was killed. His bullet-riddled body was found stuffed in the trunk of his car at the bottom of a lake. Local police reported it was done by car-jackers.

...Mary K. Olsen...

Who I Am

As the Mars Global Surveyor program manager, I am officially responsible for "program formulation, external advocacy, establishing policy, defining the objectives and requirements, allocating resources and assessing performance of the project." But really, my job is to try to facilitate the work of a superb group of managers, engineers, scientists and technicians at the Jet Propulsion Laboratory (JPL), who, working with Lockheed Martin Astronautics (LMA) in Denver, Colorado, are building and will operate the Mars Global Surveyor spacecraft.

My Career Journey

My background does not readily lend itself to managing space programs. When I was growing up I wanted to be an oceanographer. I took as many math and science courses as my small high school offered to prepare myself for college. But my family has a long history of military service and I felt it was my duty to serve my country also.

I applied to several colleges in Hawaii, Rhode Island and Texas for oceanography programs. Texas A&M was doubly intriguing; I applied for an ROTC scholarship there, as well as to the oceanographic program. I also applied to the U.S. Naval Academy. I was accepted at all of them! The unique opportunity to attend the Academy stood out so I accepted an appointment there. I took a lot of math, science and engineering courses, and graduated in 1981 as an Ensign in the U.S. Navy with a Bachelor of Science degree. I was stationed in Guam, where I forecast typhoons; in Monterey California, where I worked with global climate models; on a deep ocean survey ship, where we did bottom surveys in both the Atlantic and Pacific Oceans (we went through the Panama Canal!!); and in San Diego, where I worked in a field office for the Defense Mapping Agency (DMA, now part of NIMA). While I was stationed in San Diego, I went to night school and got my M.S. degree in Systems Management at USC. When I left active duty in 1988, I moved straight to Washington DC to work for DMA as a civilian.

So, what does all this have to do with NASA and Mars?! Absolutely nothing, directly. The math, science and engineering background, however, was very important.

I applied for a program analyst position at NASA Headquarters in 1991. After a few years analyzing the budget and schedule/cost performance of many different space science programs, I started to get bored. One of my supervisors gave me the opportunity to move into the program management area. I assisted the person who was then managing the Mars Observer mission. After Mars Observer was lost, I moved into the management of several smaller Discovery-class missions: the Near Earth Asteroid Rendezvous and the Mars Pathfinder mission. When Congress allowed NASA to start the Mars Surveyor Program, I was fortunate enough to be selected to manage the first mission in that series, the Mars Global Surveyor.

Why I Like My Job

The job required a lot of on-the-job training, extra classes and seminars, but boy, is it worth it!! The best part of my job is working closely with the real experts at JPL and LMA. You can learn so much if you just listen and ask questions. And let's face it, working with the team building the next Mars orbiter is about as neat a job as anyone could imagine!

I spend quite a bit of time on travel, to JPL and other sites for project reviews, or participation in study teams. I also am now the acting resource manager for NASA's Office of Space Science, so I am doing two jobs now, which really keeps me busy!

Personal

I'm married to a communications/electrical engineer who works for a consulting company, and we don't have any children. I do have two very spoiled cats, named Bug and Ashburn, and just spent a weekend looking for a horse to buy. I love to go horseback riding, and I've started sailing competitively again this summer (something I did while in college and in the Navy). My husband builds and flies remote-control airplanes. I grew up in upstate New York, but now live in Reston, Virginia; near enough to downtown DC to commute to work every day but far enough in the country that the deer eat my flowers all summer!

I would like to stay with NASA the next several years to see how the "New NASA" shakes out, and see all the new missions on the drawing board actually fly. Once I decide to leave, we will probably move further west in Virginia, so I can have my horse on my own property, and I will probably work for one of the small spacecraft companies in the region

The Program Manager for Mars Surveyor at NASA Headquarters in Washington, Mary K. Olsen, went to Jet Propulsion Lab in Pasadena a few months ago, wound up in a hospital with a very strange and anomalous embolism, and died. She was only 35 years old.

...Marc Aaronson - American astronomer...

Born	August 24, 1950 Los Angeles
Died	April 30, 1987 (aged 36)
Fields	Astronomy
Alma mater	Caltech
Notable awards	George Van Biesbroeck Prize (1981) Bart J. Bok Prize (1983) Newton Lacy Pierce Prize in Astronomy (1984)

Marc Aaronson (24 August 1950[1] – 30 April 1987) was an American astronomer.

Birth

Aaronson was born in Los Angeles.

Education

Aaronson was educated at the California Institute of Technology, where he received a BSc in 1972. He completed his Ph.D. in 1977 at Harvard University with a dissertation on the near-infrared aperture photometry of galaxies.[2] He joined Steward Observatory at the University of Arizona as a Postdoctoral Research Associate in 1977 and became an Associate Professor of Astronomy in 1983. Aaronson and Jeremy Mould won the George Van Biesbroeck Prize in 1981 and the Newton Lacy Pierce Prize in Astronomy in 1984 from the American Astronomical Society. He was also awarded the Bart J. Bok Prize in 1983 from Harvard University.

His work concentrated on three fields: the determination of the Hubble constant (H_0) using the Tully-Fisher relation, the study of carbon rich stars, and the velocity distribution of those stars in dwarf spheroidal galaxies.

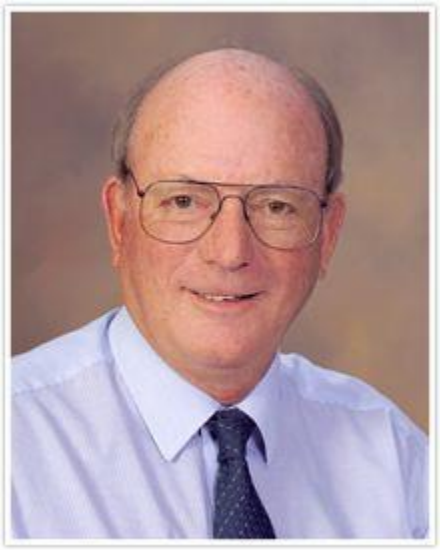
Aaronson was one of the first astronomers to attempt to image dark matter using infrared imaging. He imaged infrared halos of unknown matter around galaxies that could be dark matter.

Death

Aaronson was killed during an accident in the evening hours of 30 April 1987, in the dome of the 4-m Mayall Telescope of the Kitt Peak National Observatory.[3] Aaronson was killed when he was crushed by the hatch leading out to the catwalk when the hatch was slammed shut on him by a ladder which extended down from the turning telescope dome. A switch on the hatch automatically shut down the dome rotation motor; however, the momentum of the dome kept it moving for a few moments, allowing it to hit the outward opening hatch. This design flaw was corrected after the accident by trimming the ladder and redesigning the hatch to slide sideways, parallel to the dome wall.

Asteroid 3277 Aaronson is named in his honor.[

...Professor Michael J. Drake, 1946-2011...*Under Drake's leadership, the UA's Lunar and Planetary Laboratory grew from a small group of geologists and astronomers into an international powerhouse of research into the solar system.*



Michael J. Drake, Regents' Professor, director of the University of Arizona **Lunar and Planetary Laboratory** and head of the department of planetary sciences, died Wednesday at The University of Arizona Medical Center-University Campus in Tucson, Ariz. He was 65.

Drake, who joined the UA planetary sciences faculty in 1973 and headed LPL and the planetary sciences department since 1994, was the principal investigator of the most ambitious UA project to date, **OSIRIS-REx**, an $800 million mission designed to retrieve a sample of an asteroid and return it to Earth. OSIRIS-REx is due to launch in 2016. It is the largest grant or contract the UA has ever received.

Drake played a key role in a succession of ever more high-profile space projects that garnered international attention for LPL and the University.

Those include the **Cassini** mission to explore Saturn, the Gamma-Ray Spectrometer onboard **NASA's Mars Odyssey Orbiter**, the **HiRISE camera** onboard **NASA's Mars Reconnaissance Orbiter** and the **Phoenix Mars Lander**.

Drake also was a Fellow of the American Geophysical Union, the Geochemical Society and the Meteoritical Society, and he was president of the latter two.

A native of Bristol, England, Drake graduated with a degree in geology from Victoria University in Manchester, and then he left for a doctoral program in geology from the University of Oregon, graduating in 1972. After a postdoctoral program at the Smithsonian Astrophysical Observatory, Drake moved to, and immediately fell in love with, Arizona.

As a young assistant professor, Drake joined a much smaller LPL in 1973. The lab occupied only a part of what is now the Kuiper Space Sciences Building, and most of his colleagues came from astronomy. Planetary sciences did not have the cachet then that it does now.

"It was, from my point of view, a strange environment," Drake wrote earlier on LPL's website. "It's like the Tower of Babel; you talk in your own language and your own jargon, and communicating across fields is surprisingly difficult. It took a few years before I think most of us began to understand what motivated the other ones, what we were really saying. I think it helped us to speak in clearer, plain English and minimize the jargon, because we came from such different backgrounds."

Regents' Professor Peter Strittmatter, director of the UA's **Steward Observatory** and head of the UA astronomy department, said Drake used those communication skills to expand LPL and form close relationships with NASA.

"Mike thought and spoke clearly so you always knew where he stood on an issue," Strittmatter said. "He was a superb director of LPL, a great leader and a great personal friend. He will be sorely missed by all of us at the University of Arizona and especially those involved in the space sciences."

Peter Smith, the principal investigator for the Phoenix Mars Lander mission, said he began working with Drake when Smith was building the camera for the 1997 **Mars Pathfinder**. He called Drake's handling of the complexities of proposal development "masterful."

"We would meet monthly to review progress and plan strategy," Smith said. "Mike always encouraged excellence and made sure that the University was providing full support to our programs. Over the years, as my career progressed through various missions to Mars, he was there when troubles surfaced and a political push was needed," said Smith, who is also part of the OSIRIS-REx mission.

"He watched our flight projects from the sidelines; his enthusiasm made it clear that he wished for a more direct involvement. After winning the project of his dreams, Mike will continue to inspire and lead through the legacy of his accomplishments."

Edgar J. McCullough, retired professor and head of the UA **geosciences department** and dean of the **College of Science**, said he and Drake became friends in the early 1970s when they would go on weeklong backpacking excursions around the West.

"When he was in planetary sciences and I was head of the geosciences department, we set up a microprobe laboratory with funding from both departments. It was the first big piece of diagnostic equipment here at a time when geoscience was becoming more of an analytical science," McCullough said. "He was the kind of faculty member you wanted because he was also strong on teaching, especially undergraduates."

McCullough said Drake helped develop promotion and tenure policies for the college and was instrumental in establishing a joint position between the colleges of science and education to create science education programs. Drake also led a major undergraduate teaching effort in planetary sciences, even though the department was created as a graduate program.

Joaquin Ruiz, executive dean of the Colleges of Letters, Arts and Science, said: "Mike was a distinguished scholar, an accomplished administrator and a good friend. His students loved him for his energy, smarts and care. He was able to run the department of planetary sciences incredibly smoothly at the same time as he was writing significant papers about the early evolution of the Earth and solar system and still have time to successfully compete for OSIRIS-REx."

Timothy Swindle, the assistant director at LPL, summed it up, saying, "Not only was he a world-class scientist, but he was a tireless advocate for the Lunar and Planetary Laboratory and all the people who have worked here. Personally, he was a friend and mentor for me, and for many others, and we will miss him deeply."

Celebration of a Life Well Lived

Michael J. Drake, 1946-2011
Regents' Professor
Head and Director

The director of the University of Arizona Lunar and Planetary Laboratory and head of the planetary sciences department

Senator Ted Stevens killed in plane crash, condition of former NASA chief Sean O' Keefe unknown

- 
Sean O' Keefe, NASA's 10th administrator.

The *Anchorage Daily News* is reporting that former NASA chief Sean O' Keefe along with ex-Alaska Senator Ted Stevens, was aboard a plane that crashed yesterday in Southwest Alaska. What is known is that five of the people on board are dead (with recent reports stating that Stevens is among them) and that the names of those living and dead have not been released officially just yet, nor have the survivors' conditions.

Senator Stevens was the longest-serving Republican in the history of the Senate until a corruption scandal derailed his political career last year.

O' Keefe was the 10th person to head NASA, a position he assumed in 2001 under the recommendation of then-president George W. Bush. In his 4 year tenure at NASA, O' Keefe led the agency through some major ups and downs.

In the time from 2001 to 2003, O' Keefe successfully oversaw the elimination of a $5 billion cost over-runs from the International Space Station construction. In 2003, O' Keefe was at the NASA helm during the *Columbia* disaster and its aftermath, which grounded the shuttles until 2005. In his last full year as head of NASA, O' Keefe worked to reorganize the space agency for President Bush's plan of returning humans to the Moon and eventually going to Mars, which included the Mars Exploration Rovers. A controversial decision by O' Keefe came in 2004 when he decided not to service the Hubble Space Telescope for fear of something going wrong with the shuttle. Hubble was eventually serviced in 2009.

O' Keefe resigned as NASA chief in 2005 and served a few years as chancellor at Louisiana State University before becoming CEO of EADS North America.

...Kevin Beurle - space scientist...

Dr Kevin Beurle (19 January 1956 – 29 May 2009) was a British space scientist and programmer at Queen Mary, University of London, who played a key role in the Cassini–Huygens mission to study Saturn and its moons. He was a specialist in space imaging systems. He was the lead Cassini programmer at QMUL, developing software and designing the spacecraft's observation sequences.[1][2][3]

Life

Beurle had one daughter, Angharad, born in 1983, and was a fifth-generation vegetarian.[4] He was a keen scuba diver [5] amongst other water sports. He began formal diving training in 1997 and trained up to the level of PADI Staff Instructor by the time of his death. He was also an enthusiastic mountaineer and skier.

In 2005, Beurle was on the Oval train during the failed 21 July 2005 London bombings.[6]

Death

Beurle died on 29 May 2009 when the hot-air balloon he was riding in collided with another and plummeted 50 m (160 ft) to the ground shortly after take-off in Cappadocia, Turkey.[7][8] He was the only fatality, though others suffered severe and, in one case, critical injuries.

...John Huchra, astronomer, dies at 61...

John Huchra came to the CfA in 1976 as a fellow, having received a B.S. from MIT and his Ph.D. from the California Institute of Technology. He was a Smithsonian astronomer from 1978 to 2005, when he became Harvard's vice provost for research and policy.

John Peter Huchra died unexpectedly on Oct. 8 at the age of 61. He was the Robert O. & Holly Thomis Doyle Professor of Cosmology and the senior adviser to the provost for research policy at Harvard.

"This news comes a deep shock to us all," said Charles Alcock, director of the Harvard-Smithsonian Center for Astrophysics (CfA). "John's career was marked with distinction for his fundamental contributions to cosmology, his tireless and effective service and advocacy for astronomy, his dedication and brilliance as a teacher and mentor, his devotion to and care for students, and his warmth and humor."

Huchra came to the CfA in 1976 as a fellow, having received a B.S. from MIT and his Ph.D. from the California Institute of Technology. He was a Smithsonian astronomer from 1978 to 2005, when he became Harvard's vice provost for research and policy. He was the director of the Whipple Observatory from 1994 to 1998, and served as the interim director of the CfA in 2004.

He recently completed his term as president of the American Astronomical Society, and was a member of the National Academy of Sciences and the American Academy of Arts and Sciences. He also served on the Decadal Survey Committee, which just released its report to help guide future investments by funding agencies in ground- and space-based astronomical facilities.

Among his many accomplishments, Huchra was perhaps best known for his leadership, with his collaborator Margaret Geller, of the CfA Redshift Survey — a pioneering effort to map the large-scale structure of the universe. The survey uncovered a "Great Wall" of galaxies extending across 500 million light-years of space. This survey and others showed that we live in a "soap bubble" universe with galaxies clustering as though on the surfaces of giant bubbles separated by huge voids.

Huchra made a number of other very important contributions to astronomy, including measurements of the Hubble constant and the discovery of Huchra's Lens, one of the most dramatic early examples of gravitational lensing.

Huchra is survived by his wife, Rebecca M. Henderson, his parents, Mieccyslaw Huchra and Helen (Lewicki), by a son, Harry, and by a sister, Christine.

Friends and colleagues of Huchra are invited to a celebration of his life in science on Dec. 3 at 3 p.m. in room 104 of the Hilles Center, located at 59 Shepard St. in Cambridge. For those unable to attend, a webcast of the memorial is being arranged.

World-renowned astronomer Donald C. Backer dies at age 66…

Don Backer (UC Berkeley Department of Astronomy photo)

Don Backer, a professor in the Department of Astronomy at the University of California, Berkeley, and a world leader in the field of radio astronomy, died on Sunday, July 25, after collapsing outside his home. He was 66.

Backer joined the UC Berkeley Astronomy Department in 1975; since 1989, he held a position both as a full professor in astronomy and as a researcher in the department's Radio Astronomy Laboratory (RAL). He served as chair of the department from 1998-1999 and from 2002-2008, and as the RAL director from 2008 until his death.

An innovative and visionary scientist, instrumentalist and observer, Backer worked in many areas of astronomy and was involved in numerous ground-breaking projects over his 40-year career. His research focused on pulsars, high-energy astrophysics, the epoch of reionization and the exploration of these topics with the most imaginative and state-of-the art instrumentation.

Equally an expert in radio astronomy techniques and engineering instrumentation, Backer insisted that his work be considered within the main body of astronomy research, and not just as radio astronomy.

"His work was characterized by a clear vision of fundamental physics, technical expertise and a

passionate enthusiasm," said UC Berkeley professor Carl Heiles, a longtime colleague of Backer's.

Backer made seminal contributions to the study of pulsars. In the early 1980s, he and several collaborators discovered the first millisecond pulsar, a neutron star spinning close to its breakup speed. He also developed an important use for the millisecond pulsar as a probe of the gravitational wave background. Dozens of researchers around the world are in active pursuit of the discovery, characterization and use of millisecond pulsars, especially for detection of gravitational waves. Backer invented and developed digital systems for the detection and precise measurement of pulsars, and they have been adopted as standards in the field and are used at the major observatories worldwide.

Backer was a pioneer in Very Long Baseline Interferometry (VLBI), a technique of linking together distant radio telescopes to produce high-resolution images, allowing the investigation of astronomical structures with microarcsecond angular resolution. He linked the RAL's 85-foot-centimeter wave telescope to a number of similar antennas distributed across the country and the world. He pursued ever-increasing resolution with the goal of imaging the environment of the black hole at the center of the Milky Way Galaxy. Researchers working in this area with Backer made the highest resolution image ever of a black hole. Backer led the VLBI consortium for several years, helping to develop both accurate radio astronomy and the study of plate motions in the earth's surface.

In the past few years, Backer initiated a unique "telescope" that consists of an array of antennas spread over pastureland to detect, via their effect on intergalactic hydrogen, the first stars and galaxies that formed in the universe. This "Precision Array To Probe the Epoch of Reionization" (PAPER) led to deployment of these telescopes in Green Bank, W. Va., and in South Africa.

"Despite starting on a small scale and fabricating all of the equipment from scratch, this project is now recognized internationally as an important step toward understanding the history of the universe," said Heiles.

As RAL director, Backer was deeply engaged in the laboratory's two major facilities, the Allen Telescope Array (ATA) and the Combined Array for Millimeter Astronomy (CARMA). Fostering the growth of three unique radio telescopes — ATA and CARMA, as well as PAPER — he was leading efforts to cover a factor of 1000 in wavelength range, promising a bright future for the lab and the field of radio astronomy. Continuing Backer's legacy, the lab will continue to move forward along this path of pioneering novel techniques, said Imke de Pater, professor and chair of UC Berkeley's Astronomy Department.

Born in Plainfield, N.J., on Nov. 9, 1943, and raised in New Jersey, Backer went off to study at Cornell University, where he graduated with a B.S. in engineering physics in 1966. He then attended the University of Manchester, where he completed an M.Sc. in radio astronomy in 1968 before returning to Cornell for further graduate studies. He received his Ph.D. from Cornell in 1971.

His early career was ignited by the discovery of pulsars and the construction by Cornell of the

world's largest radio telescope, the Arecibo dish in Puerto Rico.

Among other honors during his long career, Backer was chosen for the prestigious Jansky Lectureship at the National Radio Astronomy Observatory in 2003. In addition, he served on countless national and international committees in astronomy.

At UC Berkeley, Backer's colleagues and former students said he will be remembered not only for his valuable research accomplishments, but also for his relentless energy, deep passion for science, and as someone who cared greatly for the people around him.

'Innately curious'

"Don was constantly challenging himself and his students, switching fields dramatically throughout his career, from pulsars to gravity waves, to the galactic center, and then to the origin of structure in the universe," said Dan Werthimer, a former student of Backer's who is chief scientist of SETI@home at UC Berkeley's Space Sciences Laboratory. "Don made pioneering contributions to each of these fields, but he didn't let it go to his head, and he always maintained his characteristic kind and gentle manner."

"I don't think I've met a finer man or a scientist that surpasses him in thoughtfulness," said UC Berkeley astronomy professor Leo Blitz, who knew Backer since they were freshmen at Cornell 48 years ago.

Backer was determined to "pass the torch to the next generation" and trained his replacements in the field of astronomy every day, added colleague Geoffrey Bower, UC Berkeley assistant professor of astronomy and one of Backer's former Ph.D. students. "That's why we have some chance of moving ahead without him."

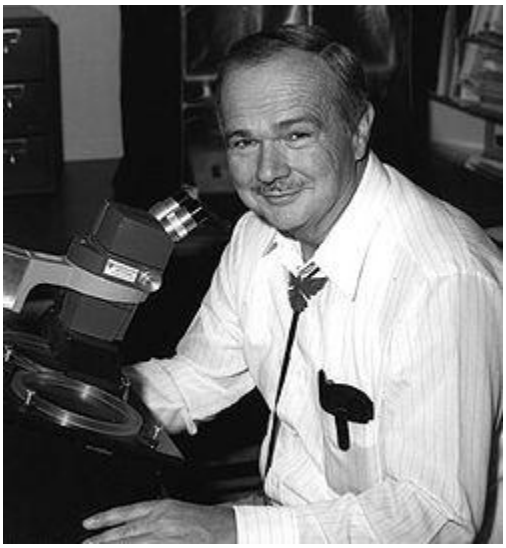
Backer's family remembers him fondly as someone who took great joy in travel, the simple and complex aspects of nature, hiking, swimming, skiing, going to the beach and camping.

"He was innately curious, loved to explore the earth as much as he did the cosmos, and had wonderful opportunities throughout his life to do both, close to home and around the world," said his son, David Backer. "Every trip, personal and professional, was another chance, not to be missed, for adventure, discovery and appreciation.

"And lucky for us, he was unflappable, capable and dependable on these quests, always prepared to start a fire with only a couple of sticks, to siphon gas with a small tube, to carry someone injured on his back to get medical assistance. We and everyone who knew him will miss his spirit, integrity and bedrock."

In addition to his wife, Susan Backer of Berkeley, Backer is survived by his son, David of Rockville, Maryland: his mother, Lura Backer of Bredenton, Fla., and a niece, a nephew and a granddaughter. His father, Phillip Backer, died in 1998 and his brother, Ken Backer, in 2007.

...Astronomer Eugene Shoemaker...



Eugene Shoemaker who co-discovered the comet that slammed into Jupiter in 1994, was killed in a car accident Friday in Australia during an annual trip to search for asteroid craters. He was 69.

Shoemaker died in a two-car accident on a dirt road about 310 miles north of Alice Springs, in central Australia, police there said.His wife, Carolyn, another Lowell Observatory astronomer who shared in the Jupiter comet's discovery, was airlifted to a hospital, where her condition was not known, police in Alice Springs said.

Shoemaker was perhaps best known for helping to discover comet Shoemaker-Levy 9, which broke up and spectacularly slammed into the giant, gaseous planet in 1994. Amateur astronomer David Levy was also on the team.

A geologist by training, Shoemaker was also a leading expert on craters and the interplanetary collisions that caused them. He lived just a short drive from Arizona's famous Meteor Crater and first proved to the scientific community that it was indeed the result of an asteroid, said University of Arizona planetary scientist Larry Lebofsky

please note that his observatory was burned to the ground one day later ... all his research was lost in the fire.

...Jeff Willick, physics assistant professor, dies in accident...

Jeffrey Alan Willick, 40, an assistant professor of physics, was fatally struck by a sports car crashing through a glass window at a Starbucks coffee shop in Englewood, N.J., on June 18.

Willick had been visiting his father, psychiatrist and Columbia University lecturer Martin Willick of Teaneck, N.J., for Father's Day. In keeping with his custom of catching up on work while traveling, Willick had been seated alone at a table for four near the window, working on his laptop computer, reading and sipping coffee when the accident occurred.

Joseph A. Santiglia, 53, of Wilkes-Barre, Pa., traveled eastbound on Route 4 before losing control of his red 2000 Mustang GT in the Starbucks parking lot and crashing into the coffee shop, according to John Higgins, assistant prosecutor for the Bergen County Prosecutor's Office in New Jersey.

Rescue workers removed Santiglia, uninjured, from his car. Willick was pinned against the car's grille. The Englewood Ambulance Squad took him to Hackensack University Medical Center, where he was pronounced dead.

Englewood police issued Santiglia a summons accusing him of driving while intoxicated, Higgins says. Santiglia had exhibited slurred speech and unsteadiness on his feet, although police did not detect the odor of alcohol, Higgins says. Authorities also cannot rule out mechanical failure at this time. A blood test is pending to determine if alcohol or drugs played a role. Results are expected in two to three weeks. In the meantime, a criminal investigation is under way.

"Jeff was a caring and conscientious classroom teacher," says Steve Chu, chairman of the Department of Physics. "He was particularly committed to involving undergraduates in research and has sponsored a half dozen undergraduates in either independent research or honors thesis projects. He was also well respected and liked by his graduate students. His research, the measurement of 'peculiar' (local) velocities of distant galaxies as a tool for probing important questions in cosmology, was adding substantial contributions to the field due to his careful analysis."

"Jeff was an active and enthusiastic member of the Stanford astrophysics

group," says Roger Romani, associate professor of physics. "His work, characterized by uncompromising attention to detail, was receiving wide attention in the cosmology community. He was very excited about the ongoing revolution in cosmology and the contributions that his group was making. Even more fundamental results were expected as he worked with the Hobby-Eberly telescope and other modern instruments. To his students, he was a dynamic and compassionate mentor. To his colleagues, he was a source of clear and original thinking on fundamental problems. This is a great loss to astrophysics in general and the Stanford community in particular."

Born on Oct. 8, 1959, Willick received bachelor's degrees in chemistry and physics from Harvard, where he was elected into Phi Beta Kappa in his junior year and graduated magna cum laude in 1981. He received a master's degree in 1983 in physics from the University of California, Berkeley. From 1983 to 1984, he taught physics at Dwight Englewood High School in Englewood, N.J. He returned to the University of California, Berkeley, for his doctoral work in physics, supporting himself as a teaching assistant in physics and as a research assistant in astrophysics. He received his doctorate in 1991.

Also that year, Willick won a Fullam/Dudley Award in astronomy. He was offered a Hubble Postdoctoral Fellowship in 1991, but he declined it to take a postdoctoral fellowship in astronomy at the Carnegie Observatories in Pasadena, where he performed research from 1991 to 1995.

Since 1995, Willick had been an assistant professor of physics at Stanford, where he produced 21 scientific articles.

In 1998, he was awarded both a Cottrell Scholarship from the Research Corporation and a Terman Fellowship from Stanford in support of his research in observational cosmology.

As a member of the Physics Department faculty, Willick taught a variety of undergraduate and graduate courses, including the popular class, "The Nature of the Universe."

His primary research interests were cosmology and the formation of structure in the universe. He focused on big questions: Is the universe flat? Is there a nonzero cosmological constant? Did structure in the contemporary universe emerge from the very nearly uniform primordial distribution of matter solely via the process of gravitational instability? What is the nature of dark matter, believed to constitute 90 percent of the total mass of the universe?

"I pursue these questions by observing the distribution and peculiar velocities of galaxies," he wrote on his website. "The methodology is primarily observational; I maintain and analyze data from large optical and infrared ground-based telescopes."

Willick, who was a resident of Stanford, is survived by his wife, Ellen, and young children Jason and Emily and other family members and friends.

"This is not only a professional loss because of Jeff's excellence in cosmology, but a personal loss based on the community and given the children," says physics Professor Blas Cabrera, who lives a block away from the Willicks. "It is going to take us a while to make some rhyme or reason of this."

Physics Associate Professor Patricia Rose Burchat, her husband, Tony, and their two small children live next door to the Willicks. Their children play together. Burchat could not be reached for comment at press time, but Jeff Willick's loss is sure to be felt throughout the close community.

No specific information regarding where to send donations or flowers is available at this time. A memorial service is planned for Wednesday, June 21, in New Jersey; a commemoration is still to be planned for the Stanford community.

UH Astronomy Founding Father Walter R. Steiger Dies In Moped-SUV Collision

An 87-year-old Hilo man said to be among the founding fathers of astronomy here in the

Hawaiian Islands died Sunday, Feb. 6, 2011 from injuries he received in a motor vehicle/scooter collision at the intersection of Komohana Street and Kukuau Street in Hilo.

The victim was identified as Walter R. Steiger of a Hilo address. Steiger was a professor emeritus at University of Hawaii and esteemed for being a frontiersman in the field of astronomy here in the state more than 50 years ago.

Responding to a 1:20 p.m. call, South Hilo patrol officers determined that Steiger was operating a 2009 Honda Metropolitan scooter and traveling west on Kukuau Street when he failed to stop at the stop sign and broadsided a 2006 Nissan SUV traveling north on Komohana Street.

The driver of the Nissan, a 51-year-old Hilo man, was not injured.

Fire rescue personnel took the Nissan passengers, a 41-year-old woman and a 9-year-old girl, to Hilo Medical Center, where they were treated for minor injuries and released.

They were all wearing their seat belts.

Steiger, who was wearing a helmet, was pronounced dead at Hilo Medical Center at 3 p.m.

It does not appear that alcohol, drugs or speed were involved in this crash.

Traffic Enforcement Unit officers have initiated a negligent homicide investigation and have ordered an autopsy to determine the exact cause of death.

BIOGRAPHY

Since retiring from the University of Hawaii at Manoa as Professor of Physics and Astronomy in 1980, I served six years with the Bishop Museum as director of the Science Center and Planetarium. During this period I was appointed by Governor Ariyoshi to the University of Hawai`i Board of Regents and served from 1982 to 1986.

The next six years were served as Site Manager of the Caltech Submillimeter Observatory (CSO) on Mauna Kea, Big Island. While in that position, I was contacted by the UH-Hilo Physics and Astronomy Department as a consultant and part-time instructor. After retiring from CSO in 1993 I spent more time teaching physics and astronomy at UH-H as an affiliate faculty. It was during these years in Hilo, that I put together my notes and photos for the historical essay Origins of Astronomy in Hawai`i, now on the Institute for Astronomy web site.

The December 31, 1999, special edition of the Honolulu Star-Bulletin recognized me as one of 100 who had made a notable impact on Hawai`i during the past 100 years.

In 2001 I was asked by the Chancellor of UH-H to help get the Mauna Kea Astronomy Education Center started during the interim search for a director. The Chancellor called me back again in 2003 when the MKAEC was in deep trouble and I served as Interim Director for 6 months until a new director could be found. Today, the MKAEC has become a fine educational facility under the name of `Imiloa Astronomy Center of Hawai`i

…David Burstein (1947 – 2009)…

 Dave Burstein was an astronomy professor here at ASU whom I worked with – largely on curricular issues – for nearly ten years. In the 1980′s he had been a member of the group of astronomers known as the "Seven Samurai" which postulated the existence of the Great Attractor, a huge, diffuse region of material around 250 million light-years away that results in the observed motion of our local galaxies. He was also a student of Vera Rubin and worked on measuring rotation curves for different galaxies-the smoking gun for dark matter. He died on December 26th after suffering from Pick's disease for a number of years. Dave was 62 years old and truly dedicated his life to ASU.

…James Ludlow Elliot…astronomer…

(17 June 1943 – 3 March 2011) was an American astronomer and scientist who, as part of a team, discovered the rings around the planet Uranus.[1] Elliot was also part of a team that observed global warming on Triton, the largest moon of Neptune.[2][3]

Elliot was born in 1943 in Columbus, Ohio and received his S.B. degree from the Massachusetts

Institute of Technology (MIT) in 1965 and his Ph.D. degree from Harvard University in 1972. Elliot was a Professor of Physics and Professor of Earth, Atmospheric, and Planetary Sciences at MIT, and Director of the George R. Wallace, Jr. Astrophysical Observatory until his death on March 3, 2011.[4]

There is some debate on whether Elliot, et al. discovered the rings of Uranus, or whether William Herschel made an observation in 1797.[5] However, scientific consensus seems to support Elliot as the discoverer.[6]

...Yuji Hyakutake...astronomer...

Yuji Hyakutake (百武 裕司 *Hyakutake Yūji*, July 7, 1950, Shimabara, Nagasaki – April 10, 2002, Kagoshima) was a Japanese amateur astronomer who discovered Comet Hyakutake on January 31, 1996 while using 25×150 binoculars.

His only other discovery was comet C/1995 Y1. The media has stated that Hyakutake became interested in astronomy after seeing Comet Ikeya-Seki (C/1965 S1).

He died in 2002, at age 51, of an aneurysm.

Asteroid 7291 Hyakutake is named after him.

…Comet discoverer Hyakutake dies…

Yuji Hyakutake, an amateur Japanese astronomer known for his discovery of a comet in 1996 that was later dubbed Comet Hyakutake, died Wednesday evening, his family said Thursday. He was 51.

According his wife, Shoko, Hyakutake suddenly started complaining of chest pains Wednesday evening. He was pronounced dead while being transported to a hospital in Kokubu, Kagoshima Prefecture.

Yuji Hyakutake

Hyakutake, a native of Shimabara, Nagasaki Prefecture, won international acclaim after discovering the comet through a powerful pair of binoculars Jan. 30, 1996, in Hayato, Kagoshima Prefecture. The discovery brought about a nationwide stargazing fad.

He had discovered another comet a month before his landmark discovery.

After Hyakutake graduated from Kyushu Sangyo University as a photography major, he worked at a newspaper in Fukuoka. He began searching for comets in 1989 and moved to Hayato, where his wife's parents live, in 1993 because "the skies are much clearer there," according to a statement he released after the comet discovery.

The amateur astronomer became the head of the municipal observatory Starland AIRA in Aira, Kagoshima Prefecture, in October 1996 and later found an asteroid.

Comet Hyakutake, which was acknowledged by the Paris-based International Astronomical Union, came to within about 16 million km of Earth in 1996.

...Arthur Young...astronomer...

Young died from diabetes.

Arthur Young, professor emeritus of astronomy at San Diego State University, died in Poway on Feb. 7, 2012, from complications of diabetes at the age of 72.

In his almost 35-year career, he was a highly respected researcher, professor and author of numerous scientific publications, many of which were co-authored by students he mentored. He was recognized by the astronomical community for his innovative research in stellar astrophysics.

Young enjoyed bringing the wonders of the universe to the public, often as guest speaker at planetarium shows in the Reuben H. Fleet Science Center and at meetings of the San Diego Astronomy Association. His passion for education was evident in the workshops he presented for

elementary and high school science teachers. He is remembered by his colleagues for his depth and breadth of knowledge and infectious enthusiasm for science. His book, *It's Turtles All the Way Down*, an analysis of the structure of scientific thought, reflects both his wit and skill in making sophisticated concepts accessible to a wide audience.

Young attended Stuyvesant High School in New York, graduating at age 16. He earned his B.S. degree from Allegheny College in Pennsylvania, followed by three years of service in the Air Force. After his military service, he entered the graduate program in astronomy at Indiana University, where he earned his Ph.D. He joined the astronomy faculty at SDSU in 1967.

...Ronald A. Parise...scientist/astronomer...

CSC Payload Specialist

Nationality	American
Status	Deceased
Born	May 24, 1951 Warren, Ohio
Died	Silver Spring, Maryland
Other occupation	Scientist astonomer
Time in space	25d 14h 13m
Missions	STS-35, STS-67
Mission insignia	

Ronald Anthony Parise Ph.D. (May 24, 1951 – May 9, 2008) was an Italian American scientist who flew aboard two NASA Space Shuttle missions as a payload specialist.

Parise was born in Warren, Ohio to Henry and Catherine Parise. By age 11, he became a licensed amateur radio operator. In his teens, he developed an interest in astronomy and aviation and

became a pilot.[1] He attended Western Reserve High School, graduating in 1969 before attending Youngstown State University. In 1973, he obtained a bachelor of science degree in physics, with minors in mathematics, astronomy, and geology. He went on to receive a master's degree in 1977 and a doctorate in 1979 from the University of Florida, both in astronomy. He and his wife Cecelia Sokol Parise had two children.

Parise died from a brain tumor on Friday, May 9, 2008 at the age of 56.[2][3]

Career

Upon graduation in 1979, Parise accepted a position at Operations Research Inc. (ORI) where he was involved in developing avionics requirements definitions and performing failure mode analyses for several NASA missions. In 1980 he began work at Computer Sciences Corp. in the International Ultraviolet Explorer (IUE) operations center as a data management scientist and in 1981 became the section manager of the IUE hardcopy facility.

In 1981 he began work on the development of a new Spacelab experiment called the Ultraviolet Imaging Telescope (UIT). His responsibilities involved flight hardware and software development, electronic system design, and mission planning activities for the UIT project. In 1984 he was selected by NASA as a payload specialist in support of the newly formed Astro mission series. During his twelve years as a payload specialist he was involved in mission planning, simulator development, integration and test activities, flight procedure development, and scientific data analysis, in addition to his flight crew responsibilities for the Astro program. At the completion of the Astro program, Parise assumed an advanced planning and communications engineering support role for a variety of human space flight projects including Mir, International Space Station (ISS), and the X-38.

Parise engaged in a number of astronomical research projects utilizing data from ground-based observatories, the Copernicus satellite (OAO-3), IUE, and the Astro observatory. His research topics, including circumstellar matter in binary star systems and the evolutionary status of stars in globular clusters, resulted in several professional publications. A veteran of two space flights, Parise logged more than 614 hours and 10.6 million miles in space. He served as a payload specialist aboard STS-35 in 1990 and STS-67 in 1995. At the end of his career, Parise supported the Goddard Space Flight Center, Networks and Mission Services Project, in the area of advanced communications planning for human spaceflight missions. He was also involved with projects in the Advanced Architectures and Automation Branch that are developing the use of standard Internet Protocols (IP) in space data transmission applications.

Spaceflight experience

STS-35/Astro-1 *Columbia* (December 2–December 10, 1990). The Astro observatory is a unique complement of three telescopes designed to simultaneously record spectral data, polarimetric

data and imagery of faint astronomical objects in the far ultraviolet. The mission duration was 215 hours and 5 minutes. The shuttle landed at Edwards Air Force Base in California.

STS-67/Astro-2 *Endeavour* (March 2–18, 1995). This was the second flight of the Astro observatory. During this record-setting 16-day mission, the crew conducted observations around the clock to study the far ultraviolet spectra of faint astronomical objects and the polarization of ultraviolet light coming from hot stars and distant galaxies. The mission duration was 399 hours and 9 minutes. The landing was at Edwards Air Force Base in California.[4]

Ron was instrumental in bringing amateur radio equipment to the shuttle and operated on the air during his own missions. His amateur radio call sign was WA4SIR.

...Robert Little....astronomer

Robert Little, the longtime AAA member who was an expert on astrophotography and wrote a much-praised book on the subject, died December 8 at his home in Brooklyn. He was 77.

Little's expertise in astrophotography and observing was recognized two years ago when he was presented with the club's rarely awarded Amateur Astronomers Medal. The medal, which recognizes meritorious service by amateurs to the science of astronomy, has been awarded only seven times since 1977.

In 1986, Little's book "Astrophotography: A Step-by-Step Approach" was published to wide acclaim. Said one reviewer: "Written by an experienced and sensitive practitioner of his subject, Little's book is packed with information and as complete as its brevity allows….Even the professional astronomer with experience in taking photographs on large research telescopes will appreciate many of Little's hints."

Even though the book is, to a large degree, dated because it was published 24 years ago, it's still used by people seeking grounding in astrophotography, including setting up telescopes and tracking techniques.

In addition to leading observing sessions, including starting those at Cadman Plaza in Brooklyn, Little taught courses on astrophotography at the Hayden Planetarium and on telescopes for the AAA. Recalls AAA president Richard Rosenberg:

"My first contact with the AAA was at Cadman Plaza, when Bob was chair there. I learned a great deal from him about observing, and thanks to his knowledge of telescopes I chose a scope I use to this day. It was through Bob's observing sessions that I had the pleasure of discovering the club."

With the late Fred Hess, Little took cruises to test the proposition that celestial objects could be photographed at sea. Their conclusion it could be done ushered in the now-widespread phenomenon of astronomy cruises. In 1972, Hess put an eclipse-trip organizer in touch with Little. Recalled Little:

"The organizer had heard negative comments about whether an eclipse could be photographed from a ship, and called Fred. I was an instructor in astrophotography at the Hayden, and Fred suggested they get in touch with me. Since I had my doubts as well, Fred and I decided to take two pre-cruises to determine if it could be done. It turned out to be absolutely easy. Thus began what's now a common way to view eclipses."

Hess and Little also organized Astronomy Island, a yearly cruise to Bermuda that was held for 15 years. Lectures were given aboard ship, as well as star ID talks on deck at night, and talks at a private viewing site. There was also an eclipse cruise off western Africa, "A Voyage into Darkness." Little lectured on astrophotography and was always getting stopped in the hallways and asked questions about how to set up cameras for the eclipse.

His photograph of a total solar eclipse, taken in conjunction with another photographer, appeared on the cover of Life magazine. Former AAA president Lynn Darsh had the picture before she met Little and was very impressed with his willingness to share his expertise.

Former AAA president Michael O'Gara said: "Bob offered to teach the art of taking pictures of the night sky to our membership and was always available to answer any question regarding photography equipment and telescopes. When an online group approached me to do a weekly show about astronomy and observing, Bob was my first guest. The topic was astrophotography, and Bob showed viewers a complete setup of how it's done."

Little worked at Scientific American as space salesman and eastern advertising manager, and for Questar, Celestron, and Bausch and Lomb. For Questar, he lectured about astronomy at schools and colleges, and on showing the sky. He was a field scientist and field technical manager for Bausch and Lomb's astronomy telescopes.

Little is survived by his wife, Ethel. ■

IRAM - PLATEAU DE BURE OBSERVATORY - ACCIDENT OF THE TELEPHERIQUE

It is with deepest sorrow that the IRAM Direction and the IRAM Partner Organisations (CNRS, IGN, MPG) have to announce the loss of 20 lives, caused by a terrible accident that hit the telepherique at the Plateau de Bure. On July 1st, 1999, at 7:15 a.m., while the cabin was on its way from the ground station, at an altitude of 1500m, to the Plateau de Bure, which is at an altitude of 2550m, an anomaly occurred which appears to have caused the cabin to reverse motion, probably accelerating, before it was destroyed when hitting the ground and continuing to tumble downwards. There were no survivors.

At present, there is no explanation as to why this accident could happen. The telepherique has been under regular maintenance by a dedicated IRAM team, and under supervision by the official safety authorities. The latest official inspection took place in December 1998.

For IRAM and its Partner Organisations it is absolutely essential that the cause of this terrible accident be found as soon as possible.

Prof. Dr. GREWING , Directeur IRAM

Dr. S. GUILLOTEAU, Directeur Adjoint IRAM

Prof. Dr. J.F. MINSTER , Centre National de la Recherche Scientifique, Institut National des Sciences de l'Univers

Prof. Dr. H. MARKL , Max-Planck-Gesellschaft zur Forderung der Wissenschaften

Prof. Dr. J. GOMEZ-GONZALEZ, Instituto Geografico Nacional

The signatories, together with the entire IRAM staff in France and Spain, express their most sincere condolences, and those of the world astronomical community, to the families, friends, colleagues, and employers of the victims.

List of the victims:

IRAM (Saint-Etienne-en-Devoluy, Hautes-Alpes):

Bernard AUBEUF
Francis GILLET
Henri GONTARD
Roland PRAYER
Patrick VIBERT

Entreprise QUEYRAS (Saint Crépin, Hautes-Alpes):
Romain DELFOSSE
Mickael EYMEOUD
Pascal MAHE
Norbert MERELLA
Bruno NOUGIER
Jean SABAR
Fabien TONDA
Senol TOPAL
Frédéric VILLAR

Entreprise GRANIOU (Vitrolles, Bouches-du-Rhône):
Sylvain AUBRY
Jean-Michel CANNONE
François MACE
Stéphane PARIS

Entreprise NERA (Gap, Hautes-Alpes) :
Lucien KOUBI
Michel ROUGNY

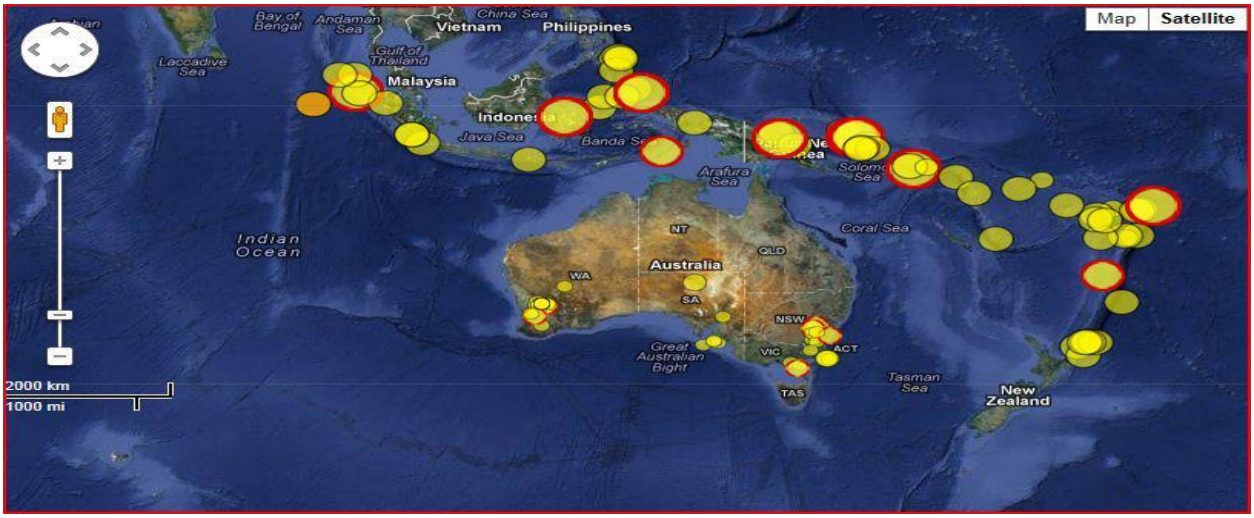
The memory of those who have lost their lives while working for our Institute and for the benefit of scientific research will always be honored at the Plateau de Bure Observatory.

Jurgen Rahe

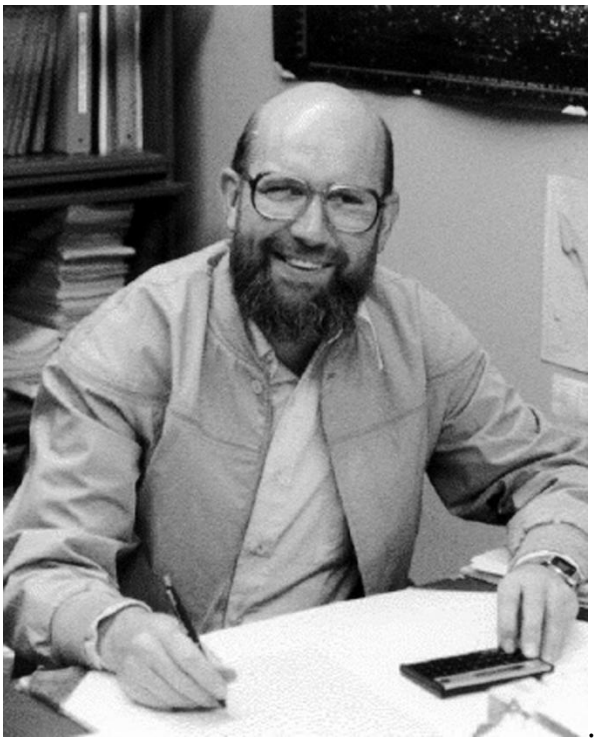
Just weeks before a sophisticated probe reaches Mars and only months before launch of a major probe to Saturn, NASA's science program director for solar system exploration was killed on 18 June in a tragic accident. Jurgen Rahe, 57, died when a tree crushed his car during a severe storm.

Rahe oversaw general management, budget, and strategic planning for solar system programs, including the Pathfinder mission to Mars that will land on 4 July and the Cassini spacecraft slated for launch to Saturn this fall. "Under his leadership, NASA's planetary exploration program was experiencing an almost unparalleled period of major discoveries at the same time that a number of new missions were being started and launched," Wes Huntress, NASA's space science chief, said in a statement. "His legacy to the exploration of space is large."

Rahe was also the editor of Astrophysics and Space Science and a member of the editorial board of two other journals, Earth, Moon, and Planets and Il Nuovo Cimento. Prior to joining NASA in 1989, he worked at the Jet Propulsion Laboratory in Pasadena, California, and also as an astronomer at the Astronomical Institute of the University Erlangen-Nuremberg in Germany.



Richard L. (Dick) Walker, Jr., 1938-2005



Dick Walker, 67, died 30 March 2005 in Flagstaff, AZ, following a long illness. He was born on 9 March 1938 in Hampton, Iowa and grew up in Waterloo, Iowa.

As a child, Dick was fascinated with astronomy and built his own telescope. He saved his pennies and bought and read every book on the subject he could find. He also raised pigeons, naming four of them Hertzsprung, Hoyle, Gamow, and Kron.

In 1957, the year Sputnik was launched, Dick began his college studies at the University of Northern Iowa in Cedar Falls. In 1959, he transferred to the State University of Iowa (subsequently renamed the University of Iowa) in Iowa City, where he earned a BA degree in astronomy and physics in 1963. He joined the staff of the U.S. Naval Observatory in Washington, DC, where he worked in the Time Service Division for a year before his assignment to the Astrometry and Astrophysics Division. Dick relocated to Flagstaff, AZ, in 1966 to continue his Naval Observatory service at the Flagstaff Station. His retirement in May 1999, ended a thirty-six-year career with USNO.

Dick was first and foremost an observational astronomer. From the mid 1960s through the late 1970s, much of Dick's time was devoted to the measurement of binary stars, observing with the 12-inch and 26-inch refractors in Washington and later the 40-inch and 61-inch reflectors in Flagstaff. He also made many trips to Lick Observatory to work with the 36-inch Clark Refractor there. During this time he consulted with Charles Worley, who was observing on the 26-inch, to make sure time was well-spent examining doubles that could not be observed in Washington. This period of observing overlapped with the early years of speckle interferometry, and Dick's

observations, made with the largest telescope used for micrometry at the time, were very important for ascertaining the veracity of this new technique.

He was a studious and very careful observer of doubles and made over 8,000 measures, resulting in almost 3,000 mean positions. While measuring known systems for orbital analysis, he discovered 22 pairs (mostly additional components to these systems) and moving pairs, and his highlighting the rapid motion of these systems resulted in them being placed on many programs and led to the more definitive orbits of today.

As a staff member of the Flagstaff Station, Dick was, for over 30 years, one of the principal observers on the 61-inch parallax program. He also ventured into other areas of astronomy, including planetary systems. He is credited with discovering the moon of Saturn, Epimetheus, in December 1966, with the USNO Flagstaff Station 61-inch Kaj Strand Astrometric Reflector. He also obtained photographic plates to determine accurate positions of the outer planets for the Voyager 2 approaches to Uranus in 1986 and Neptune in 1989.

It is interesting to note that Dick's career in observational astronomy spanned three different eras of astronomical instrumentation and technique. He began his career doing eyeball astronomy, using a filar micrometer to measure double star separations. Photographic astronomy then became dominant and he took many thousands of plates. During the last ten years of his career, electronic cameras, primarily CCDs, replaced photographic plates. He readily adapted to the changing technologies.

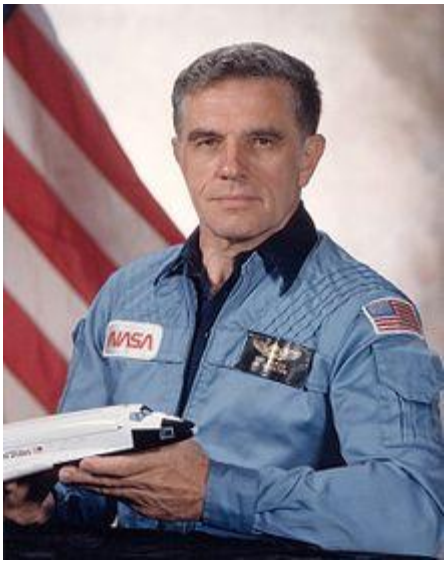
A man of many interests, Dick was fascinated by the history of astronomy, especially archeoastronomy, as well as Egyptology. He taught himself the language of hieroglyphics. In 1977, having accumulated several weeks of vacation time, he set off on a trek to walk the Nile for 500 miles from Aswan to Cairo. One night, in the town Asyut along the Nile, he was brought into the police station. The local inhabitants found it hard to credit his story that he was simply on a walk and questioned him as a possible Israeli spy.

Following his retirement from the Naval Observatory, Dick consulted in a couple of construction projects. He designed the analemma and the skywalk star fields for the Koch Center for Science, Math, and Technology at Deerfield Academy in Massachusetts. He also consulted with James Turrell, providing astronomical position information for the design of the Roden Crater Project outside of Flagstaff.

While he will be remembered for his significant scientific contributions to the field of astronomy, those who knew Dick, both scientists and non-scientists alike, will probably remember him best for his humility, his humanity, and his loyal and abiding friendship. He was a man with a terrific sense of humor and an infectious laugh. It was always an honor and pleasure to be in his company.

Richard L. Walker, Jr. is survived by his wife, Patricia, two daughters from his first marriage: Brenda Walker of Las Vegas, NV, and Pamela Hepburn of Holland, OH, as well as four children from Patricia's first marriage: Doug Browning of Lake Havasu City, AZ, Michael Browning of Kingman, AZ, Kim Bructo of Orient, OH, and Jennifer Brown of Lake Havasu City, AZ. He is

also survived by ten grandchildren and three great-grandchildren. He was preceded in death by his father Richard, mother Mary, and daughter, Paula Jean Elizabeth Stone.



Karl Gordon Henize

Ph.D. (17 October 1926 – 5 October 1993) was an astronomer, NASA astronaut, space scientist, and professor at Northwestern University. He was stationed at several observatories around the world, including McCormick Observatory, Lamont-Hussey Observatory (South Africa), Mount Wilson Observatory, Smithsonian Astrophysical Observatory and Mount Stromlo Observatory (Australia). He was in the astronaut support crew for Apollo 15 and Skylab 2/3/4. As a mission specialist on the Spacelab-2 mission (STS-51-F), he flew on Space Shuttle Challenger in July/August 1985. He was awarded the NASA Exceptional Scientific Achievement Medal in 1974. Nebula Henize 206 was first catalogued in the early 1950s by Dr. Henize.[1] He died in 1993, during an effort to summit Mount Everest.

++

When Charlene Heisler was about to embark on her PhD in astronomy. Charlene, what could be more fun than the excitement of probing the cores of galaxies and uncovering the secrets of the Universe? This sense of fun propelled her right through her PhD, which she survived despite the doctors' warnings, and then through a further eight years during which she built a distinguished career as an internationally-renowned astronomer working at some of the world's top observatories.

After taking her Honors degree at Calgary, Canada, in

⋯Charlene Heisler (1961 - 1999)

1985, she took her PhD at Yale, in the USA. In her 1991 PhD thesis, she studied a class of galaxies (Peakers) which were brightest at far-infrared wavelengths, and showed that they represented a brief phase of activity, triggered by an interaction with another galaxy. She then took up a postdoctoral position at York University, Canada, in which she continued to study Peakers and other active galaxies. In 1993 she moved to Sydney, Australia, to take up a postdoctoral position at the Anglo-Australian Observatory, and in 1996 she moved to Mount Stromlo Observatory, Canberra, where, in 1998, she was awarded a prestigious Senior Fellowship.

In 1997 she published perhaps her most significant paper, which tackled the question of why some active galaxies emit broad spectral lines visible only in polarized light. She and her colleagues showed that this "broad line" emission depends on the infrared colour and extinction of the galaxy, and that the observed properties of these galaxies depend strongly on their orientation with respect to the observer.

Her last major project was the COLA (Compact Objects in Low-power AGN) project, to see if Active Galactic Nuclei (AGN) were linked to starburst activity. One of her greatest contributions to this project was her intellectual honesty, and her habit of asking the hard question. Will it work? Do we have enough resolution? Do we have enough objects in our sample to give a statistically significant result? These vigorous discussions gradually honed the project into one that won large amounts of time on the world's major telescopes, and attracted several distinguished international collaborators.

A 1998 visit to Chile to take observations for this project turned out to be Charlene's last observing trip. Shortly after returning to Australia, her disease started taking the upper hand. She received a lung transplant in early 1999, which at first looked a success. Two days after the transplant she was on an exercise bike. A few days later she was taking work to her hospital bed for refereeing, and within a few weeks she was analyzing data from our last spectroscopy run. But such transplants have only a 50% success rate, and the narrow path between rejection and infection is strewn with obstacles. Despite an excellent prognosis and all signs of a first-class recovery, on 28 October 1999 she suddenly

deteriorated and passed away.

However, her pivotal contributions to science still live on, and her friends continue to publish papers bearing her name. But even more significant was Charlene's effect on other people. Several young people would not now be in science had it not been for Charlene's encouragement and guidance. As one student commented: "she was a wonderful friend, a big sister and an incredible inspiration".

Charlene inspired many of us to do better science, while not losing sight of our inner human selves. She showed that professional relationships don't have to be sterile, formal, caricatures, but that good science is fun, and good scientists can be warm, sincere, human beings.

...William L. Burke..astronomer-astrophysics...

William Lionel Burke (1941 July – 1996 July) was an astronomy, astrophysics, and physics professor at UC Santa Cruz. He is also the author of *Spacetime, Geometry, Cosmology* (ISBN 0-935702-01-6), and of *Applied differential geometry* (ISBN 0-521-26929-6), a text expounding the virtues of differential forms over vector calculus for theoretical physics.

Born in Bennington, Vermont, Burke obtained his Bachelor of Science degree from Caltech in 1963. His 1969 doctoral thesis, also at Caltech and supervised by Kip Thorne, Richard Feynman, and John Wheeler, was entitled *The Coupling of Gravitational Radiation to Nonrelativistic Sources.* His discovery of the Burke Potential, an aspect of gravitation overlooked by Einstein himself, dates from this period. He became a full professor at UCSC in 1988.

Burke is also known as the godfather of the Santa Cruz "Chaos Cabal" also known as the dynamical systems collective, that nurtured the seminal work of MacArthur Fellow Robert Shaw, Norman Packard, Doyne Farmer and James Crutchfield. In Tom Bass' book The Eudaemonic

Pie, Burke prided himself for his Rubik's Cube costume at the end of the book which kept his identity concealed from his students.

An avid hiker, climber, skier, sailor, wind surfer, and Go player, Bill Burke died from complications due to a cervical fracture sustained in an automobile accident. Bill's understanding of science is paraphrased by his thinking: "Never descend the Grand Canyon with less than two geologists."

Bill was married and then divorced from his wife Pat (Patricia).

...Ronald Cecil Stone, 1946-2005...

Ronald C. Stone, an astronomer at the US Naval Observatory Flagstaff Station, passed away on 10 September 2005 in Downer's Grove, IL, following a valiant struggle with cancer. He was fifty-nine years old.

Ron was born on 9 June 1946 in Seattle, Washington, to Helen (Vocelka) and Cecil Stone. His father was a World War II veteran who attended college on the GI Bill and became a mechanical engineer. He and his wife raised three sons: Dwight, Ronald, and Gavin. They lived in a number of locations across the U.S. before settling at last in Downer's Grove when Ron was in the fourth grade.

Ron's interest in astronomy began when he was given a toy planetarium projector while still in grade school, and later a small telescope. In high school, he also built his own telescope, grinding

the 6-inch mirror by hand.

He completed grade school and high school in Downer's Grove and did his undergraduate studies at the University of Illinois at Urbana-Champaign, majoring in astronomy and physics and graduating cum laude in 1968. The following year, he was drafted into the U.S. Army and served for two years, including a stint in Vietnam. Although his primary assignment was auditing, he was also involved in the defense of the Long Binh base in Vietnam. He was honorably discharged from the service in 1971 and enrolled that fall at the University of Chicago.

While a graduate student working with Bill van Altena, Ron developed his life long interest in the field of astrometry. Van Altena recalls him as "a quiet and cheerful student who wanted to learn, and [who] worked hard to understand the intricacies of astrometry... deriving the most precise proper motions from the 40-inch [Yerkes] refractor plates." Working at Yerkes Observatory in Williams Bay, Wisconsin, he completed a thesis entitled, "Mean Secular Parallax at Low Galactic Latitude." While living in Wisconsin, Ron also became engaged to Ellen Mickel, and the two were married at his parents' home in Downer's Grove.

After earning his Ph.D. in 1978 from Chicago, Ron held a number of research and postdoctoral positions. These included a few months at the Venezuelan National Observatory in Merida, where he helped to set up an astrometric program. This work was unfortunately cut short because of difficulties obtaining the requisite work visa. He also had a two year postdoc at Northwestern University, where he did spectroscopy of massive stars and studied various open clusters. Ron and Ellen's first child, Heather, was born on 9 June 1981 in Evanston, IL.

Ron and Ellen moved to Washington, DC, in 1981, where Ron joined the staff of the U.S. Naval Observatory Transit Circle Division. Their son, Geoffrey, was born on 10 May 1983. The marriage ended in divorce in 2001.

During the three years that he spent at the USNO headquarters, Ron received training in observing and data reduction with the 6-inch transit circle. When in 1984 the observatory opened the Black Birch Station in New Zealand for surveying the southern sky with the 7-inch transit circle, Ron joined the first group of astronomers to transfer. There he became involved in developing software for the 7-inch, particularly with the image dissector and the acquisition and reduction of planetary observations. Together with Ellis Holdenreid, he worked on some aspects of the real time control software for the 7-inch. He also continued to work on his earlier interest in runaway OB stars.

When Ron's tour at the Black Birch Station was coming to an end, he requested a transfer to the USNO Flagstaff Station in northern Arizona. There was a transit circle at the Flagstaff Station being fitted with a CCD camera, and Ron's experience with transit circles in Washington and Black Birch made him well-qualified to help with the modernization of this instrument.

Ron worked with David and Alice Monet to automate the 8-inch and develop astrometric software for reducing and analyzing its observations. This telescope came to be known as the FASTT, for Flagstaff Astrometric Scanning Transit Telescope. It was used from 1992 onward to obtain highly accurate astrometric positions of various Solar System bodies that were targets of

several NASA space missions. In addition, Ron observed astrometric calibration regions for the Sloan Digital Sky Survey. He collaborated in projects to predict and observe stellar and planetary occultations, determine the masses of certain asteroids, and improve the orbits of numerous planetary satellites.

In his letter recalling Ron Stone's career, Bill van Altena wrote, "I also knew and respected Ron as a scientist who worked to do the very best that he could with the FASTT system and produced an outstanding set of data that will be remembered as setting the standards for the best that could be done with drift scanning astrometry."

Ron used FASTT observations of radio stars and the brightest quasars to confirm the tie between the optical and radio reference frames. He developed extensive software for automated reduction of FASTT observations. During his last year of life, he took on the additional responsibility of bringing another new telescope, the 1.3-meter, into operation, and was making good progress in this effort until his illness forced him to relinquish the task.

Besides his professional interests, Ron was a avid outdoorsman. During his years in Williams Bay, he rode a motorcycle and enjoyed SCUBA diving. He is one of the few people to have gone diving in Lake Geneva. He liked nothing better than hiking and exploring wilderness areas. As his brother, Dwight, recalled, "If he saw a mountain, he had to climb it!"

...Other deaths...

Father **Malachi Martin** spoke publicly about the coming of Planet X and the purpose of the Vatican-sponsored observatory near Tucson, Arizona, and recently ended up dead.

On June 25, 1997, the day of the supposed burn for the spacecraft and mid-course correction, and the day of the MIR “accident”, a Senior Program Director at NASA Headquarters, Dr. **Gergen Ray**, was found dead near his home in Potomac, Maryland, under unusual circumstances.

A few days prior to that, a computer technician working on Pathfinder, in Palo Alto, California, was found dead. His body was wedged between a tree and a fence in a very well-traveled, upper-class residential-shopping area near Stanford University. Officials in his case claim that he was beaten to death by gang members.

Jeffrey A. Willick (1959-2000) observational cosmologist
[link to 66.249.93.104] car crash

Marc Aaronson (1950-1987) astronomer

[link to en.wikipedia.org] workplace accident

Michael Ledlow (1964-2004) astronomer
[link to www.gemini.edu] brain tumor

Karl G. Henize (1926-1993) astronaut
[link to en.wikipedia.org] respiratory and heart failure

William L. Burke (1941-1996) astrophysicist
[link to en.wikipedia.org] car accident

Charlene Heisler (1961-1999) astronomer
[link to www.atnf.csiro.au] complications after lung transplant.

Richard J. Elston (1960?-2004) astronomer
[link to www.astro.ufl.edu] cancer

Rebecca A. Elson (1960-1999) astronomer
[link to en.wikipedia.org] cancer

Beatrice M. Tinsley (1941-1981) cosmologist
[link to en.wikipedia.org] cancer

And lets add
Jan H. Oort (1900-1992) radio astronomer
[link to en.wikipedia.org] complications after a fall

...List of the dead astronomers...

1.	Koh – Ichiro Morita	2012	murdered
2.	Steven Rawlings	2012	murdered
3.	Rodney Marks	2000	poisoned
4.	Richard Crowe	2012	vehicle accident
5.	Yoram Kaufman	2006	vehicle accident
6.	Don Osterbrock	2007	surprise heart attack
7.	Brian Marsden	2010	acute encephalomyelitis
8.	Al Rex Sandage	2010	acute encephalomyelitis
9.	David Schramm	1997	plane crash
10.	Brewster Shaw	1997	shot to death
11.	Mary K Olsen		anomalous embolism
12.	Marc Aaronson	1987	killed at observatory
13.	Michael J Drake	2011	liver cancer
14.	Sean O Keefe	2005	plane crash

15. Kevin Beurle	2009	ballooning accident
16. John Huchra	2010	unknown death (unexpected)
17. Donald C Backer	2010	collapsed outside house
18. Eugene Shoeaker	1997	car accident
19. Jeff Willick	2000	strange vehicle accident
20. Father Malachi Martin	1999	Brain hemorrhage
21. Gergen Ray	1997	died at home
22. Computer tech (JPL)		strange vehicle accident
23. Michael Ledlow	2004	brain tumor
24. Karl G Henize	1993	heart attack
25. Charlene Heisler	1999	died in hospital
26. Richard A Elston	2004	cancer
27. Bdatrice M Tinsley	1981	cancer
28. Rebecca A Elson	1999	cancer
29. Jan H Oort	1992	complications after a fall
30. Walter R Steiger	2011	vehicle accident
31. David Burstein	2009	neurodegenerative disease
32. James Elliot	2011	cancer
33. Edwin E Salpeter	2008	leukemia
34. Arthur Young	2012	diabetes
35. Yuji Hyakutake	2002	aneurysm
36. Robert Little	2010	unexplained
37. Jorgen Rahe	1997	freak accident
38. Richard L Walker Jr	2005	cancer (long term)
39. Ronald A Parise	2008	brain tumor
40. William L Burke	1996	car accident
41. Ronald Cecil Stone	2005	cancer
42. Robert S Harrington	1993	back cancer
43. 20 astronomers	1999	cable car accident

Bernard AUBEUF ... Francis GILLE T… Henri GONTARD … Roland PRAYER
Patrick VIBER T… Romain DELFOSS E… Mickael EYMEOUD … Pascal MAHE
Norbert MERELLA … Bruno NOUGIER … Jean SABAR … Fabien TONDA
Senol TOPAL … Frédéric VILLAR … Sylvain AUBR Y… Jean-Michel CANNONE
François MACE … Stéphane PARIS … Lucien KOUB… Michel ROUGNY

General info on Robert Harrington, Tom van Flandern and Eugene shoemaker....

...Robert Harrington...

Robert Sutton Harrington (October 21, 1942 – January 23, 1993) was an American astronomer who worked at the United States Naval Observatory (USNO). Harrington was born near Newport News, Virginia. His father was an archaeologist. He was married to Betty-Jean Maycock in 1976, with two daughters, Amy and Ann.[1]

Harrington worked at the USNO. Another astronomer there, James W. Christy, consulted with him after discovering bulges in the images of Pluto, which turned out to be Pluto's satellite Charon.[1] For this reason, some consider Harrington to be a co-discoverer of Charon, although Christy usually gets sole credit. By the laws of physics, it is easy to determine the mass of a binary system based on its orbital period, so Harrington was the first to calculate the mass of the Pluto-Charon system, which was lower than even the lowest previous estimates of Pluto's mass.

Harrington became a believer in the existence of a Planet X beyond Pluto and undertook searches for it, with positive results coming from the IRAD probe in 1983. Harrington collaborated initially with T. C. (Tom) Van Flandern.[1] They were both "courted" by Zecharia Sitchin and his followers who believe in a planet Nibiru or Marduk, who cite the research of Harrington and van Flandern as possible collaborating evidence, though no definitive proof of a 10th planet has surfaced to date.

Harrington died of esophageal cancer in 1993.[1] The asteroid 3216 Harrington was named in his honour.

...ROBERT HARRINGTONS PAPER ON PLANET X...

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Abstract

- The observation of the region of the sky in which it is believed Planet X should now be, based on perturbations observed in the motions of Uranus and Neptune, was determined, and there was no reason to update that determination. A limited area of that region was photographed, and that will be continued. A given area is photographed with the twin 20 cm astrograph in New Zealand on two successive nights near the time that area is in opposition, and these plates are blinked in Washington to identify anything that has moved. The predicted region is in the south, which requires observations from a southern station, and it is in opposition in the April to June period, which means observations have not yet started for the year. Blinking will be done as soon as the plates are received in Washington.

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THE LOCATION OF PLANET X

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ABSTRACT

Planet X, if it exists at all, is most likely to be found, at present, in the region of Scorpius, with a considerably lesser likelihood that it is in Taurus.

In 1930, Tombaugh found the planet Pluto. This was the result of a systematic search initiated at Lowell Observatory as the result of predictions made by Lowell as to the position and nature of a supposed additional planet in our solar system. At the time, Pluto was hailed as the object of that prediction, even though there were anomalies in its appearance and orbit evident right from the time of its discovery. Since then, these problems have only become more serious, and the discovery of its satellite in 1978 revealed a mass of Pluto that could not have caused any of the perturbations in the orbits of Uranus and Neptune used to predict the existence of a ninth planet. For a complete review of the discovery of Pluto and the developments leading up to the suspicion of the existence of a tenth planet, see Seidelmann and Harrington (1988).

The motions of Uranus and Neptune cannot be adequately represented within the present gravitational model of the solar system. Pluto cannot have any detectable effect on these two planets. There is therefore a good possibility that there is at least one undetected planet in our solar system, and it is now possible to set some constraints on where that planet might be.

The observations used in this study were taken from compilations of all positional determinations available through 1982 for each planet of interest. These observations are quite varied in nature and source and include both visual and photographic determinations. The Uranus observations go back to 1833 and the Neptune ones to 1846. These compilations were supplied by the Nautical Almanac Office of the U. S. Naval Observatory. They consist of observed positions of Uranus and Neptune, along with residuals in right ascension and declination from positions computed from DE200 (Standish 1982a,b). The residuals were first converted to residuals in ecliptic longitude (great circle) and latitude. As a statistical approximation, this is not correct, since these data are not statistically independent. However, for the present analysis this makes no difference, and it greatly facilitates the subsequent comparison with numerical simulations.

These residuals were then combined into seasonal normal points, producing average geocentric residuals spaced slightly more than a year apart. These residuals were then assumed to be adequate representations of the equivalent heliocentric average residuals for the observed oppositions. There are usually enough observations per opposition, with enough balance pre- and post-opposition, that the small systematic errors within each observation should tend to cancel out in the mean. The exception would be that, in the mean, heliocentric residuals should be, at most, a few percent smaller in magnitude, an effect that is well below the noise level within each normal point. In any case, these short-period differences do not affect the long-period effects being sought. Finally, a weight was assigned to each normal point. Weights based upon the rms scatter within each normal would give the bulk of the weight to the observations after about 1920, and therefore on modern transit-circle observations. However, it is important to give enough weight to early observations to give them some significance in a solution for long-period effects. Therefore, the weights were based merely on the square root of the number of observations per normal. A few tests indicated that this consideration is not significant for the final results.

The item of interest for the present analysis is the perturbation in the orbit of a known planet, produced by the presence of an unknown Planet X. (X can be thought of as either representing the unknown or the number 10.) Hence, the equations of motion are cast in the form of the motions of the residuals in rectangular coordinates. For numerical work, this is known as Encke's method, and the description followed here comes from Brouwer and Clemence (1961). The method relies on the fact that it is being applied only to the orbits of Uranus and Neptune. These planets are sufficiently distant, move sufficiently slowly, and are perturbed sufficiently little that all vectors representing planetary positions, whether known or unknown but assumed, as they appear in the derivatives of the perturbations, can be represented by approximate vectors. For assumed Planet X orbits, two-body motion is assumed. For Uranus and Neptune, the low-precision formulas as given by Van Flandern and Pulkkinen (1979) are employed.

Additional assumptions are that the perturbations are sufficiently small that expansions in them are only required through first order and that the mass of the perturbed planet need not be included in the solar gravitational constant representing the principal term in the acceleration of the perturbation (both of these have been numerically verified). The result of this development is a set of relatively simple equations of motion that can be integrated very quickly for a given orbit of Planet X. A reintegration of the entire outer solar system is not needed for each test case and, indeed, only the positions of the perturbing and the perturbed planets (the perturber and the perturbee) are required.

To be specific, let $\boldsymbol{\xi}$ be the vector of perturbations of an observed planet, caused by Planet X, from the vector $\mathbf{r}$ of the predicted position of the observed planet, based on the known gravitational model of the solar system (i.e., the actual vector of observations is $\mathbf{r} + \boldsymbol{\xi}$). The vector $\mathbf{r}$ is approximated as described above. Let $\mathbf{r}_X$ be the position vector of Planet X. Let μ be the gravitational constant of the Sun and μ_X be that of Planet X. The equation of motion for the perturbation vector can therefore be written as follows:

$$\ddot{\boldsymbol{\xi}} = \frac{\mu}{|\mathbf{r}|^3}\left(\frac{3\mathbf{r}\cdot\boldsymbol{\xi}}{|\mathbf{r}|^2}\,\mathbf{r} - \boldsymbol{\xi}\right) + \mu_X\left(\frac{\mathbf{r}_X - \mathbf{r}}{|\mathbf{r}_X - \mathbf{r}|^3} - \frac{\mathbf{r}_X}{|\mathbf{r}_X|^3}\right).$$

The numerical procedure is to pick some mass and state vector of Planet X, and to integrate the above equation to each of the observed epochs, using closed formulas (not series) to compute **r**. The rectangular perturbations are rotated into the plane of the sky at each epoch to produce predicted longitude and latitude perturbations, and constant and secular terms are removed to produce a set of predicted perturbations to be compared with the observed ones.

The experimental procedure was to systematically pick masses and position vectors for Planet X, to pick a constellation of velocity vectors around and including that of the circular orbit for each position and mass, such that the directions are distributed uniformly around the circular vector and the magnitudes incremented to vary the total kinetic energy in uniform specified steps. In this case, four energy steps were taken about each circular orbit (each energy step represented an increment of 10% of the circular energy), the distances were varied in increments of 10 AU from 30 to 80, longitudes in 1 hr increments from 1 to 24, latitudes in 15° increments from -45 to $+45$, and the mass in increments of $1.\mathcal{M}_\oplus$ from 3 to $5.\mathcal{M}_\oplus$, for a total of 172 368 test cases for each run. This was carried out for both Uranus and Neptune, giving a grand total of just over a third of a million trials.

Only those cases for which the rms scatter of the observed residuals about the predicted ones were 10% or more below the raw observed rms residuals were saved for further analysis. There were no such cases for post-discovery observations of Neptune. For Uranus, the resulting orbits were used to compute 1988 heliocentric positions for the planet, and these were found to cluster in two relatively limited regions of the sky (as has to be the case, these regions are almost directly opposite each other). The first region runs from approximately right ascension 3^h to 7^h, declination $-10°$ to $+50°$, and the other from 14^h to 21^h and $-70°$ to $-10°$. The positions for each region are plotted in Fig. 1, with the positions from the best-fit orbits highlighted. The best-fit positions cluster toward the center of each region, as would be expected, indicating that the most likely location in each case is towards the center of each region. There are far more points in the southern region than in the northern, however, with the same degree of concentration of the best ones. Counting overlapping points, there are 30 test orbits represented in the first region and 153 in the second, suggesting perhaps more than 5 to 1 odds that the planet is in the southern region. For comparison, Fig. 2 shows the locations predicted for 1930, along with the discovery location of Pluto. The comparison of Pluto's location with the predicted low-probability location of Planet X shows the degree to which Pluto was mimicking Planet X at that time. Thus, the Lowell search, which was concentrating on that solution accessible to it, found Pluto coincidently close to a possible location for Planet X at that time.

Powell (1988) has carried out a solution of the problem using an approach that at many points is very similar to that used here. He has used weighted oppositional normal points of residuals, of the planet Uranus, and he has made similar approximations to concentrate on the perturbations themselves. However, he has formally solved for a best-fit orbit, and, although he finds local best fits in the same two regions of the sky, he has concentrated on the solution giving the absolute best fit. He has also taken as a first iteration a zero-eccentricity, zero-inclination orbit, legitimate for the known planets but possibly not so for this case. His prediction is indicated as well in Fig. 1. It is consistent with the above results at some level, but it is farther east than suggested here even for that region, presumably as a result of the more rapid motions that would be required of an approximately circular orbit near the extremes of the observational interval.

Gomes and Ferraz-Mello (1988) have also examined this problem, again with a similar approach, allowing for eccentricity but no inclination for Planet X. They also conclude that Uranus is the more suitable indicator planet, and both of

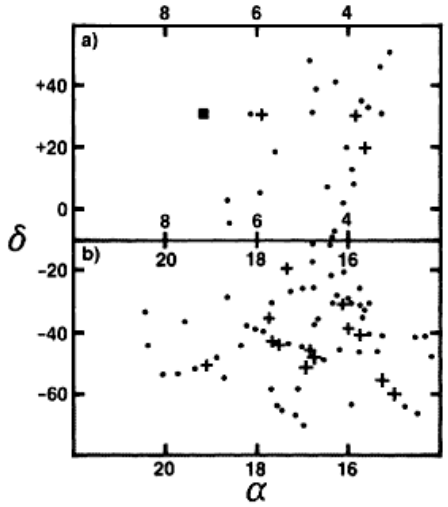

FIG. 1. Positions predicted for 1988 best-fit solutions. (a) is northern-winter positions, (b) southern-summer. + 's represent very best fits, ●'s other best fits, ■ the prediction of Powell.

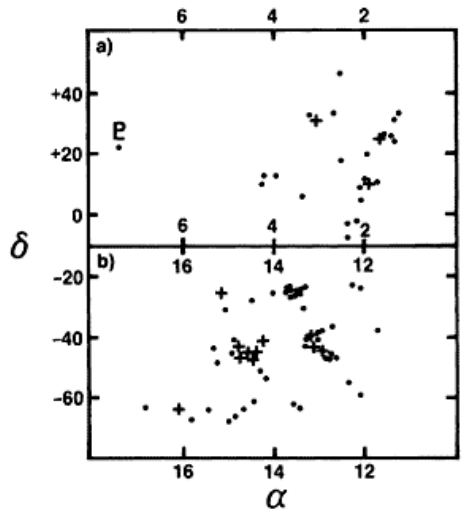

FIG. 2. Same as Fig. 1, but with positions predicted for 1930. P indicates position of Pluto at discovery.

their reasonable solutions give a present position close to the one given by Powell.

A further consideration here is the complete Lowell planetary survey. After discovering Pluto, Tombaugh continued looking for any additional planets for another 13 yr, covering a good portion of the northern sky down to approximately 16th magnitude (see Tombaugh and Moore (1980) for a complete description of the Lowell survey). While it is perfectly possible that he could have overlooked Planet X, for a variety of reasons, the indications are that his search was quite thorough. From this alone, it can be suggested that the probability that the planet is in the north is quite low. The quasiquantitative results here support this conclusion. Therefore, not as a best solution, but as a typical good case, the following nominal orbit may be used to locate Planet X:

Perihelion Epoch T:	6 August 1789
Semimajor axis a:	101.2 AU
Period P:	1019 yr
Eccentricity e:	0.411
Argument of perihelion ω:	208.5
Argument of node Ω:	275.4
Inclination i:	32.4
Mass m:	$4.\mathcal{M}_{\oplus}$
Absolute magnitude $V(1,0)$:	-6 (assumed)

The above gives positions in 1930–1943 between 14^h and 15^h and south of $-41°$, an area only marginally covered, at best, at this magnitude by Tombaugh. The present position is now 16.0^h, $-38°$, magnitude 14. Any search should use the above only as a starting point to cover the indicated broad region.

I would like to thank Tom van Flandern, who first convinced me that Planet X might be real and worth looking for, and whose thinking guided the initial stages of this project. Ken Seidelmann gave me access to the Uranus and Neptune residual data, as well as continued advice and criticism on the project in general. Finally, special thanks to Conley Powell, who continually kept me abreast of his progress in his calculations, as I attempted to do for him.

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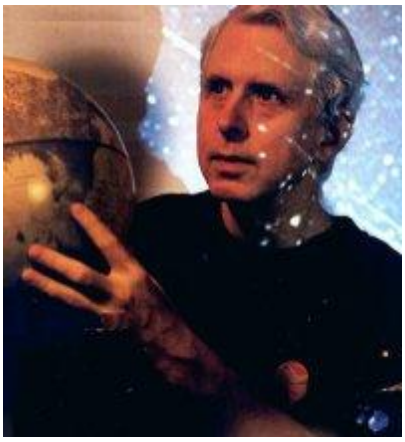
...Tom Van Flandern...



Born	June 26, 1940 Cleveland, Ohio
Died	January 29, 2009 (aged 68) Seattle, Washington[1]
Residence	Sequim, Washington
Nationality	American
Fields	Astronomy and pseudo-science
Institutions	U.S. Naval Observatory, Meta Research
Alma mater	Yale University

Thomas C Van Flandern (June 26, 1940 – January 9, 2009) was an American astronomer and author specializing in celestial mechanics. Van Flandern had a career as a professional scientist, but was noted as an outspoken proponent of non-mainstream views related to astronomy, physics, and extra-terrestrial life. He also published the non-mainstream *Meta Research Bulletin*. He died in Sequim, Washington after a brief battle with cancer.[2]

Early life and the US Naval Observatory

While in High School, Van Flandern helped create the Cleveland Moonwatchers organization to track satellites that gained national attention during the sputnik launch of 1957.[3][4] He was still engaged in this activity when he helped found a Moonwatchers team at Xavier University.[5] According to the Smithsonian's Astrophysical Observatory the team, under Van Flandern's direction, broke a tracking record in 1961.[6][7] This early interest in Lunar Occultations paved the way for important work later in life.

Van Flandern graduated from Xavier University cum laude with a B.S. in Mathematics in 1962 and was awarded a teaching fellowship at Georgetown University.[8][9] He attended Yale University on a scholarship sponsored by the U.S. Naval Observatory (USNO),[*citation needed*] joining USNO in 1963.[10] In 1969 he received a PhD in Astronomy from Yale, with a dissertation on lunar occultations. Van Flandern worked at the USNO until 1983,[11][12] first becoming Chief of the Research Branch[13] and later becoming Chief of the Celestial Mechanics Branch of the Nautical Almanac Office.[14][15][16]

He became an expert on refining the lunar orbit from timings of lunar occultations, then the best observations for that purpose. He encouraged observations by providing observers with predictions of occultations for their locations. He designed a cable system connecting all observers timing a grazing occultation, to record their observations at a central station. After a 1964 success, four amateur astronomical societies built similar cable systems.[9]

General philosophy

Van Flandern described in his book [17] how he noted a regular practice of not re-examining the fundamental assumptions underlying a theory once it gained "accepted" status, almost no matter how incompatible some new observation or experiment might be. He wrote:

> *Events in my life caused me to start questioning my goals and the correctness of everything I had learned. In matters of religion, medicine, biology, physics, and other fields, I came to discover that reality differed seriously from what I had been taught. As a result of this questioning process, I was startled to realize how much of my "knowledge" was indeed questionable.*

At this time he also expressed his views of the future of science to *Science Digest* magazine:

> *As science progresses we will eventually unravel the mystery of our origins, and the solution will come sooner if our minds are prepared to accept the truth when it is found, however fantastic it may be. If we are guided by our reason and our scientific method, if we let the Universe describe its wonder to us, rather than telling it how it ought to be, then we will soon come to the answers we seek, perhaps even within our own lifetimes.*[18]

In later years, Van Flandern advocated inquiry into astronomy theories which he felt were consistent with the principles of science but were not otherwise supported because they

conflicted both with observations and verified theories. He espoused 10 principles for assessing ideas and dubbed theories in compliance as "Deep Reality Physics."

> *Physicists and mathematicians have fundamentally different approaches to describing reality. The essential difference is that physicists adhere to certain logical principles, any violation of which would amount to a miracle; whereas the equations of mathematics generally are oblivious to physical constraints. This leads to drastically different views of what is, and what is not, possible for cosmology and the reality we live in. Physics that adheres to these logical principles is known as "deep reality physics".*[19]

Mainstream scientific work

During the mid-1970s, Van Flandern believed that lunar observations gave evidence of variation in Newton's gravitational constant G, consistent with a speculative idea that had been put forward by Paul Dirac. Years later, with new data available, Van Flandern himself admitted his findings were not significant, and the conclusions were contradicted by more accurate findings based on radio measurements with the Viking landers.[20][21]

Following the first reports by David Dunham in 1978 of occultation observations suggesting satellites for some asteroids [22], Van Flandern and others began to report similar observations [23]. Such occultation observations are not regarded as conclusive, and in fact detailed observations made by the Hubble Space telescope of some of the objects predicted to have satellites based on occultation observations made by Dunham and Van Flandern have failed to reveal any satellites.[24] This confirms that the occultation method was not reliable. Nevertheless, the prevailing view at the time was that such satellites probably do exist, and the first solid evidence of them came in 1993 with the imaging from the Galileo spacecraft[25][26].

Van Flandern and Henry Fliegel developed an algorithm to calculate a Julian date from a Gregorian date that would fit on a single IBM card. They published this in a paper, "A machine algorithm for processing calendar dates" in 1968 in the Communications of the Association for Computing Machinery. This was used in countless business applications worldwide.[9]

With Kenneth Pulkkinen, he published "Low precision formulae for planetary positions", in the Astrophysical Journal Supplement in 1979. The paper set a record for the number of reprints requested from that journal.[9]

Non-mainstream science and beliefs

Speed of gravity

In his article, "The speed of gravity—What the experiments say" he asserted that laboratory, solar system, and astrophysical experiments for the speed of gravity yield a lower limit of 2x10^10 c.[27]

This article was commented on by Marsch and Nissim-Sabat[28] (followed by a reply by Van Flandern.[29]) Steve Carlip wrote another comment concluding that lack of observed aberration was compatible with speed-of-light propagation of gravitational effects. [30]

> In the absence of direct measurements of propagation speed, observations must be filtered through theory, and different theoretical assumptions lead to different deductions. In particular, while the observed absence of aberration is consistent with instantaneous propagation (with an extra interaction somehow added on to explain the gravitational radiation reaction), it is also consistent with the speed-of-light propagation predicted by general relativity.

In a subsequent paper Van Flandern and Jean-Pierre Vigier claimed to have found mistakes in Carlip's paper in his discussion of electromagnetic interactions and extended the discussion to quantum theory as well.[31] Other non-mainstream authors made similar claims.[32] [33]

However, those claims were not accepted by the majority of the scientific community, whose opinion is that the analysis of general-relativity experts such as Steve Carlip and others are correct, *i.e.* that the speed of gravitational as well as electromagnetic propagation is that of light.[34]

Le Sage's theory of gravitation

Van Flandern attempted to rehabilitate Le Sage's theory of gravitation, according to which gravity is the result of a flux of invisible "ultra-mundane corpuscles" (c-gravitons) impinging on all objects from all directions at superluminal speeds. He gave public lectures claiming that this flux could be a source of limitless energy,[35][36] which he believed could be used as a means of propulsion for space vehicles ("useful for getting around in the galaxy").

Face on Mars

Van Flandern was a prominent advocate of the belief that certain geological features seen on Mars, especially the "face at Cydonia", are not of natural origin, but were produced by intelligent extra-terrestrial life, probably the inhabitants of a major planet once located where the asteroid belt presently exists, and which Van Flandern believed had exploded 3.2 million years ago.[37] He gave lectures on the subject,[38] and at the conclusion of the lectures he described his overall conception:[*citation needed*]

> "We've shown conclusively that at least some of the artifacts on the surface of Mars were artificially produced, and the evidence indicates they were produced approximately 3.2 million years ago, which is when Planet V exploded. Mars was a moon of Planet V, and we speculate that the Builders created the artificial structures as theme parks and advertisements to catch the attention of space tourists from Planet V (much as we may do on our own Moon some day, when lunar tourism becomes prevalent), or perhaps they are museums of some kind. Remember that the Face at Cydonia was located on the original equator of Mars. The Builder's civilization ended 3.2 million years ago. The evidence suggests that the explosion was anticipated, so the Builders may have departed their

> world, and it produced a massive flood, because Planet V was a water world. It is a coincidence that the face on Mars is hominid, like ours, and the earliest fossil record on Earth of hominids is the "Lucy" fossil from 3.2 million years ago. There have been some claims of earlier hominid fossils, but Lucy is the earliest that is definite. So I leave you with the thought that there may be a grain of truth in The War of the Worlds, with the twist that WE are the Martians.

"Face on Mars" is listed number four in an astronomers ranking of astronomical pseudo-science topics[39]

Publications

Van Flandern authored a book, *Dark Matter, Missing Planets and New Comets: Paradoxes Resolved, Origins Illuminated*,[40] in which he rejected and offered replacements for the fundamental theories of modern physics (especially special relativity, general relativity, and quantum mechanics), and challenged prevailing notions regarding dark matter, the big bang, and solar system formation, and advocated the theory that the asteroid belt consists of the remains of an exploded planet. He issued newsletters, papers, and maintained a website devoted to his ideas, which have not found acceptance within the mainstream scientific community.

Van Flandern published the *Meta Research Bulletin* which reported the newest discoveries and how they presented difficulties to accepted astronomical theories, such as the Big Bang and planetary formation. The Bulletin claimed mainstream scientists preferred making ad hoc corrections to the theories rather than acknowledge fundamental difficulties that might jeopardize their funding.[9]

A list of his main scientific publications is available through Scholar.[41]

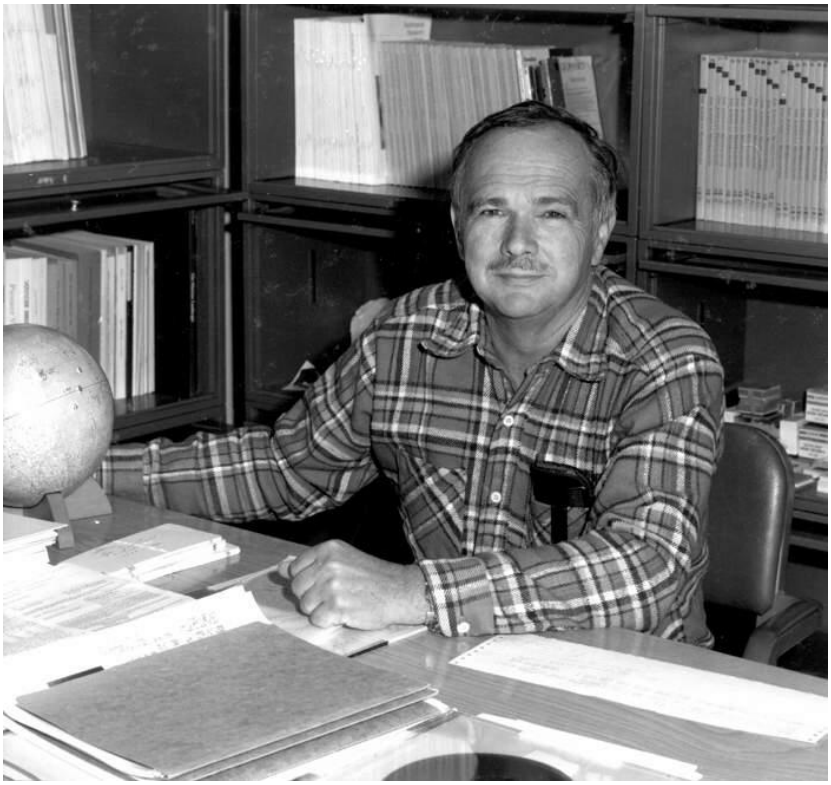
Awards and honors

In 1974, his essay, "A Determination of the Rate of Change of G",[42][43] was awarded second place by The Gravity Foundation.[44]

In 2009, asteroid 52266 was named in honor of Van Flandern because:[45]

> predicted and comprehensively analyzed lunar occultations at the U.S. Naval Observatory in the 1970s. In 1979 he published pioneering papers on the dynamics of binary minor planets. He helped improve GPS accuracies and established Meta Research to support alternative cosmological ideas.

…EUGENE SHOEMAKER (1928-1997)…



Gene Shoemaker, renowned both as a geologist and an astronomer, and a member of the Board of Directors of The Spaceguard Foundation, was killed instantly on the afternoon of July 18, when his car collided head-on with another vehicle on an unpaved road in the Tanami Desert northwest of Alice Springs, in the Northern Territory of Australia. His wife Carolyn, who had closely collaborated with him in both his geological and his astronomical activities for many years, was injured in the accident and is in stable condition in Alice Springs Hospital.

Born in Los Angeles, California, on 1928 April 28, Eugene Merle Shoemaker graduated from the California Institute of Technology in Pasadena at the age of 19. A thesis on the petrology of Precambrian metamorphic rocks earned him a master's degree only a year later, at which point he joined the United States Geological Survey, an organization with which he remained at least partly associated for the rest of his life. His first work for the USGS involved searching for uranium deposits in Colorado and Utah. While doing this, he also became interested in the moon, the possibility of traveling there, and of establishing the relative roles of asteroidal impacts and volcanic eruptions in forming the lunar craters. He then embarked on work for a Ph.D. at Princeton University, intending to continue his study of metamorphic petrology, although this was interrupted when the USGS again sent him to the field, this time leading him to an investigation of volcanic processes, for it was in the eroded vents of ancient volcanoes that the uranium deposits were often located.

Gene Shoemaker and Carolyn Spellman were married in 1951. A visit to Arizona's Meteor Crater the following year began to set Gene toward the view that both it and the lunar craters were due to asteroidal impacts. In 1956 he tried to interest the USGS in the construction of a geological map of the moon. This work was sidelined, because the national interest in the production of plutonium led him to study of the craters formed in small nuclear explosions under the Yucca Flats in Nevada and invited a comparison with Meteor Crater. It was then that he did his seminal research on the mechanics of meteorite impacts that included the discovery, with Edward Chao, of coesite, a type of silica produced in a violent impact. Awarded a master's degree in 1954, Gene Shoemaker received his doctorate from Princeton in 1960 with a thesis on Meteor Crater.

In 1961 he took a leading role in the USGS venture, in Flagstaff, Arizona, into the study of "astrogeology", the Ranger missions to the moon and the training of the astronauts. It had long been Gene's dream to go to the moon himself, but in 1963 he was diagnosed as having Addison's disease, a condition that prevented him from becoming an astronaut. When the USGS Center of Astrogeology was founded in Flagstaff in 1965, he was appointed its chief scientist and organized the geological activities planned for the lunar landings. In 1969 he returned to Caltech as a professor of geology and served for three years as chairman of the Division of Geological and Planetary Sciences there. Until he retired from the professorship in 1985 he divided his time between Pasadena and Flagstaff. He continued to maintain an office in the USGS Astrogeology building after his formal retirement in 1993, while at the same time taking up a position at the Lowell Observatory.

It was shortly after the 1969 arrival in Pasadena that he became interested in extending his geological knowledge of the formation and distribution of terrestrial and lunar impact craters to the study of the astronomical objects that formed them. With Eleanor Helin he developed a plan to search for such objects--the Apollo asteroids--with the 0.46-m Schmidt telescope at Palomar. This search program had its first success in July 1973 and was soon, with the help also of a number of students and of collaborations using other Schmidt telescopes, significantly augmenting the rather meager knowledge that had been accrued on these objects during the previous four decades.

Carolyn became involved with measuring images from the Palomar films in 1980, and in 1982 the Helin and the Shoemaker observing programs with the 0.46-m Schmidt went their separate ways. Carolyn proved to be very adept at scanning the Schmidt films, and this new phase of the search program had its first success with the discovery of (3199) Nefertiti, an Amor asteroid with its perihelion 0.13 astronomical unit outside the earth's orbit. In 1983 the first of the record 32 comets associated with the Shoemaker name was discovered. By the time the observing program ended, in late 1994, it had produced 40 of the--now--417 known Amor, Apollo and Aten asteroids (the orbits of this last group being smaller than that of the earth). Together with the other observing programs at Palomar, the Shoemakers have ensured that Palomar recently became and is likely to remain the leading site for the discovery of asteroids, with currently more than 13 percent of asteroids that have been numbered having been found there. A few months before the Shoemaker program was terminated came its "defining moment", with Gene receiving the thrill of his lifetime when some 20 components of one of those 32 comets were observed to crash into the planet Jupiter with astoundingly dramatic results.

Carolyn also went along on Gene's annual trips to Australia to examine impact craters, and the tragic irony that his own death should occur there as the instantaneous result of another violent impact would not have been lost on him. Gene lived as he died, active to the hilt, his enquiring mind participating in the adventure of ever learning more over an unusually large range of scientific disciplines. His many honors included the Wetherill Medal of the Franklin Institute in 1965, election to membership in the National Academy of Sciences in 1980, the Gilbert Award of the Geological Society of America in 1983 and the Kuiper Prize of the American Astronomical Society in 1984. Above all, he was truly the "father" of the science of near-earth objects, to the discovery and study of which The Spaceguard Foundation is dedicated, and his expertise and drive will be sorely missed.

PART 2. DOWN THE RABBIT HOLE WE GO…

Atacama Large Millimeter Array

ALMA logo

Organisation	Multi-national
Location	Llano de Chajnantor Observatory Atacama Desert, Chile
Coordinates	23°01′9.42″S 67°45′11.44″W
Altitude	5,058.7 m (16597 ft)
Telescope style	at least 50 identical 12 m reflectors connected by fiber-optic cables

Website	Official ALMA site Official NRAO ALMA site Official ESO ALMA site Official NAOJ ALMA site

The **Atacama Large Millimeter/sub-millimeter Array** (**ALMA**) is an array of radio telescopes in the Atacama desert of northern Chile. Since a high and dry site is crucial to millimeter wavelength operations, the array is being constructed on the Chajnantor plateau at 5000 metres altitude. Consisting of 66 12-meter and 7-meter diameter radio telescopes observing at millimeter and sub-millimeter wavelengths, ALMA is expected to provide insight on star birth during the early universe and detailed imaging of local star and planet formation.

ALMA is an international partnership between the United States, Canada, Europe, East Asia and the Republic of Chile. Costing more than a billion US dollars,[1] it is the most expensive ground-based telescope currently under construction. ALMA began scientific observations in the second half of 2011 and the first images were released to the press on 3 October 2011. The project is scheduled to be fully operational by the end of 2012.

The initial ALMA array will be composed of 66 high-precision antennas, and operate at wavelengths of 0.3 to 9.6 mm. The array will have much higher sensitivity and higher resolution than existing sub-millimeter telescopes such as the single-dish James Clerk Maxwell Telescope or existing interferometer networks such as the Submillimeter Array or the *Institut de Radio Astronomie Millimétrique* (IRAM) Plateau de Bure facility.

The antennas can be moved across the desert plateau over distances from 150 m to 16 km, which will give ALMA a powerful variable "zoom", similar in its concept to that employed at the Very Large Array (VLA) site in New Mexico, US.

The high sensitivity is mainly achieved through the large numbers of telescopes that will make up the array.

The telescopes are provided by the European, North American and East Asian partners of ALMA. The American and European partners have each placed orders for twenty-five 12-metre diameter antennas, that will compose the main array. East Asia is contributing 16 antennas (four 12-metre diameter and twelve 7-metre diameter antennas) in the form of the Atacama Compact Array (ACA) which is also part of the enhanced ALMA.

By using smaller antennas than the main ALMA array, larger fields of view can be imaged at a given frequency using ACA. Moving the antennas closer together will enable the imaging of sources of larger angular extent. The ACA will work together with the main array in order to enhance the latter's wide-field imaging capability.

ALMA has its conceptual roots in three astronomical projects: the Millimetre Array (MMA) of the United States, the Large Southern Array (LSA) of Europe, and the Large Millimetre Array (LMA) of Japan.

The first step toward the creation of what would become ALMA came in 1997, when the NRAO (National Radio Astronomy Observatory) and the ESO (European Southern Observatory) agreed to pursue a common project that merged the MMA and LSA. The merged array combined the sensitivity of the LSA with the frequency coverage and superior site of the MMA. ESO and NRAO worked together in technical, science, and management groups to define and organize a joint project between the two observatories with participation by Canada and Spain (the latter became a member of ESO later).

A series of resolutions and agreements led to the choice of "Atacama Large Millimeter Array", or ALMA, as the name of the new array in March 1999 and the signing of the ALMA Agreement on February 25, 2003, between the North American and European parties. Following mutual discussions over several years, the ALMA Project received a proposal from the NAOJ (National Astronomical Observatory of Japan) whereby Japan would provide the ACA (Atacama Compact Array) and three additional receiver bands for the large array, to form Enhanced ALMA. Further discussions between ALMA and NAOJ led to the signing of a high-level agreement on September 14, 2004, that makes Japan an official participant in Enhanced ALMA, to be known as the Atacama Large Millimeter/sub-millimeter Array.

During an early stage of the planning of ALMA, it was decided to employ ALMA antennas designed and constructed by known companies in North America, Europe and Japan rather than using one single design. This was mainly for political reasons. Although very different approaches have been chosen by the providers, each of the antenna designs appears to be able to meet ALMA's stringent requirements.

Funding

ALMA was initially a 50-50 collaboration between the United States National Radio Astronomy Observatory and European Southern Observatory (ESO). The array has been extended with the help of the new Japanese, Taiwanese, and Chilean partners.[2] ALMA is the largest and most expensive ground-based astronomical project currently under construction (current cost estimate is US$1.3 billion).[*citation needed*]

Partners

- European Southern Observatory and the European Regional Support Centre
- National Science Foundation via the National Radio Astronomy Observatory and the North American ALMA Science Center
- National Research Council of Canada
- National Astronomical Observatory of Japan (NAOJ) under the National Institutes of Natural Sciences (NINS)
- ALMA-Taiwan at the Academia Sinica Institute of Astronomy & Astrophysics (ASIAA)
- Republic of Chile

Assembly

The complex will be built primarily by European, U.S., Japanese and Canadian companies and universities. Three prototype antennas have undergone evaluation at the Very Large Array site in New Mexico since 2002.

General Dynamics C4 Systems has been contracted by Associated Universities, Inc. to provide twenty-five of the 12m antennas,[3] and European manufacturer Thales Alenia Space has been signed up to provide the other twenty-five principal antennas[4] (in the largest-ever European industrial contract). The first antenna was delivered in 2008, and the rest will be delivered at about one per month, finishing in 2011.

Scientific results

Images from initial testing

Antennae Galaxies composite of ALMA and Hubble observations

By the summer of 2011 sufficient telescopes were operational during the extensive program of testing prior to the Early Science phase for the first images to be captured.[9] These early images give a first glimpse of the potential of the new array that will produce much better quality images in the future as the scale of the array continues to increase.

The target of the observation was a pair of colliding galaxies with dramatically distorted shapes, known as the Antennae Galaxies. Although LMA did not observe the entire galaxy merger, the result is the best submillimeter-wavelength image ever made of the Antennae Galaxies, showing the clouds of dense cold gas from which new stars form, which cannot be seen using visible light.

Global collaboration

The Atacama Large Millimetre/sub-millimetre Array (ALMA), an international astronomy facility, is a partnership of Europe, North America and East Asia in cooperation with the Republic of Chile. ALMA is funded in Europe by the European Southern Observatory (ESO), in North America by the U.S. National Science Foundation (NSF) in cooperation with the National Research Council of Canada (NRC) and the National Science Council of Taiwan (NSC) and in East Asia by the National Institutes of Natural Sciences of Japan (NINS) in cooperation with the Academia Sinica (AS) in Taiwan. ALMA construction and operations are led on behalf of Europe by ESO, on behalf of North America by the National Radio Astronomy Observatory (NRAO), which is managed by Associated Universities, Inc (AUI) and on behalf of East Asia by the National Astronomical Observatory of Japan (NAOJ). The Joint ALMA Observatory (JAO) provides the unified leadership and management of the construction, commissioning and operation of ALMA.

Project timeline

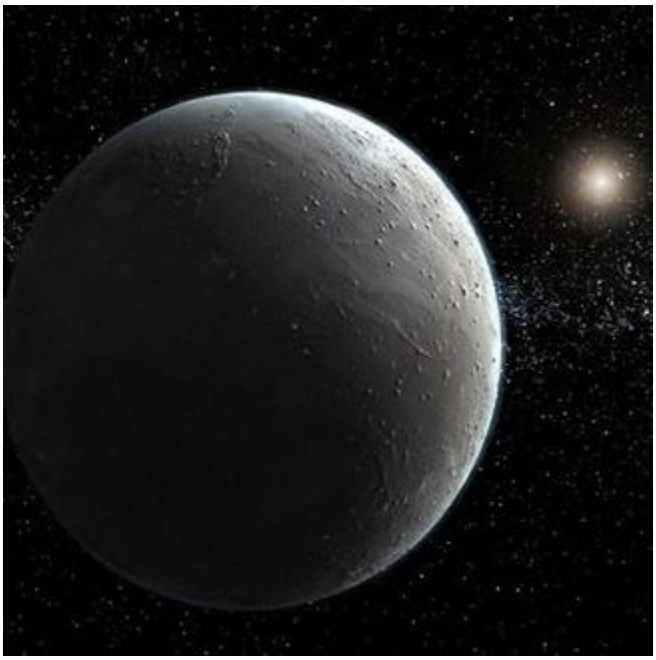
Timeline

Date	Activity
1995	ESO/NRAO/NAOJ joint site testing with Chile.
May 1998	Start of Phase 1 (Design & Development).
June 1999	European/U.S. Memorandum of Understanding for Design & Development.
February 2003	Final European / North American Agreement, with 50% of funding from ESO, and 50% of funding shared between USA and Canada.
April 2003	Testing of first prototype antenna begins at the ALMA Test Facility (ATF) site in Socorro, New Mexico.
November 2003	Groundbreaking ceremony at ALMA site.
September 2004	European, North American & Japanese draft agreement, with Japan providing new extensions to ALMA.

October 2004	Opening of Joint ALMA office, Santiago, Chile.
September 2005	Taiwan joins the ALMA Project through Japan.
July 2006	European, North American & Japanese amend agreement on the Enhanced ALMA.
April 2007	Arrival of first antenna in Chile.
February 2008	Arrival of the two ALMA transporters in Chile.
July 2008	First antenna movement with a transporter.
December 2008	Acceptance of the first ALMA antenna.
May 2009	First interferometry with two antennas at the Operations Support Facility (OSF).
September 2009	First move of an ALMA antenna to Chajnantor.
November 2009	Phase closure with three antennas at Chajnantor.
2010	Call for shared-risk Early Science proposals.
Second semester 2011	Start of Early Science.
End 2012	ALMA Inauguration.

...Japanese scientists eye mysterious 'Planet X'...

Scientists at a Japanese university said Thursday they believed another planet up to two-thirds the size of the Earth was orbiting in the far reaches of the solar system.



Scientists at a Japanese university said Thursday they believed another planet up to two-thirds the size of the Earth was orbiting in the far reaches of the solar system.

The researchers at Kobe University in western Japan said calculations using computer simulations led them to conclude it was only a matter of time before the mysterious "Planet X" was found.

"Because of the very cold temperature, its surface would be covered with ice, icy ammonia and methane," Kobe University professor Tadashi Mukai, the lead researcher, told AFP.

The study by Mukai and researcher Patryk Lykawka will be published in the April issue of the US-based Astronomical Journal.

"The possibility is high that a yet unknown, planet-class celestial body, measuring 30 percent to 70 percent of the Earth's mass, exists in the outer edges of the solar system," said a summary of the research released by Kobe University.

"If research is conducted on a wide scale, the planet is likely to be discovered in less than 10 years," it said.

Planet X -- so called by scientists as it is yet unfound -- would have an oblong elliptical solar orbit and circle the sun every thousand years, the team said, estimating its radius was 15 to 26 billion kilometres.

The study comes two years after school textbooks had to be rewritten when Pluto was booted out of the list of planets.

Pluto was discovered by the American astronomer Clyde Tombaugh in 1930 in the so-called Kuiper belt, a chain of icy debris in the outer reaches of the solar system.

In 2006, nearly a decade after Tombaugh's death, the International Astronomical Union ruled the celestial body was merely a dwarf planet in the cluttered Kuiper belt.

The astronomers said Pluto's oblong orbit overlapped with that of Neptune, excluding it from being a planet. It defined the solar system as consisting solely of the classical set of Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune.

The team noted that more than 1,100 celestial bodies have been found in the outer reaches of the solar system since the mid-1990s.

"But it would be the first time to discover a celestial body of this size, which is much larger than Pluto," Mukai said.

The researchers set up a theoretical model looking at how the remote area of the solar system would have evolved over the past four billion years.

"In coming up with an explanation for the celestial bodies, we thought it would be most natural to assume the existence of a yet unknown planet," Mukai said.

"Based on our hypothesis, we calculated how debris moved over the past four billion years. The result matched the actual movement of the celestial bodies we can observe now," he said.

He was hopeful about research by Kobe University, the University of Hawaii and Taiwan's National Central University.

"We are expecting that the ongoing joint celestial observation project will eventually discover Planet X," Mukai said.

...Patryk Lykawka...

Brazilian astronomer working with the Japanese.

The search for the mythical Planet X may not be over yet. Scientists at Kobe University, Japan, announced that they believe another planet is orbiting within our solar system, up to two-thirds the size of the Earth. Yes, Trekkers, Planet-X is back!

The Kuiper Belt terminates suddenly at a distance of 55 Astronomical Units from the Sun, and there is some speculation this may be caused by the presence of an object with a mass between that of and Earth located beyond what is known as the Kuiper cliff at 55 AU.

Patryk Lykawka, an astronomer at Kobe University, Japan, claims that we will prove this object's existence or lack thereof by 2013. Lykawka's computer simulations suggest that a body roughly the size of Earth, ejected outward by Neptune early in the Solar System's formation and currently set in elongated orbit between 80 and 170 AUs from the Sun, While some astronomers have cautiously supported Lykawka's claims, others have dismissed them as contrived.

The study by Tadashi Mukai, the lead researcher and Patryk Lykawka -to be published in the April issue of the US-Based Astronomical Journal- however apparently is based in nothing more than supposition. The pair from Kobe University set up a theoretical model that focused on the Kuiper belt – similar to the asteroid belt sitting between Mars and Jupiter, but out past Neptune and far larger; 20 times as wide and 20–200 times as massive.

The model was designed to look at the area and how it would have evolved over the past four billion years. "In coming up with an explanation for the celestial bodies, we thought it would be most natural to assume the existence of a yet unknown planet," Mukai said. "Based on our hypothesis, we calculated how debris moved over the past four billion years. The result matched the actual movement of the celestial bodies we can observe now."

So, as far as I can see, there isn't anything like the gravitational effects that were played out on Neptune that led to astronomer Clyde Tombaugh locating Pluto in 1930 in the Kuiper belt, a chain of icy debris in the outer reaches of the solar system. In 2006, nearly a decade after Tombaugh's death, the International Astronomical Union ruled the celestial body was merely a dwarf planet in the cluttered Kuiper belt.
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So for all of us that intend to have that piece of trivia knowledge over our mates at a future pub visit, let's keep our fingers crossed they finally locate Planet-X (and reinstate Pluto. It would be a bit anti-climactic to once again find a ninth planet!).

Links :

https://sites.google.com/site/patryksofialykawka/home his website

patryksan@gmail.com his email address

Subaru Telescope···Japanese observatory

...Located in Hawaii next to the United States Naval Observatory...

The Subaru Telescope

Organization	National Astronomical Observatory of Japan
Location	Mauna Kea, Hawai'i, USA
Coordinates	19°49′32″N 155°28′36″WCoordinates: 19°49′32″N 155°28′36″W
Altitude	4139 m[1]
Wavelength	Optical/Infrared
Built	Completed 1998
Telescope style	Cassegrain
Diameter	8.3 m[2] (8.2m usable)
Secondary dia.	1330/1400/1265 mm[3]
Angular resolution	0.23″[3]

Collecting area	~53 m²
Focal length	f/1.83 (15.000 m)[3]
Mounting	altitude/azimuth
Dome	cylindrical
Website	http://www.naoj.org/

Subaru Telescope (In Japanese: すばる望遠鏡) is the 8.2 metre flagship telescope of the National Astronomical Observatory of Japan, located at the Mauna Kea Observatory on Hawaii. It is named after the open star cluster known in English as the Pleiades. It had the largest monolithic primary mirror in the world from its commission until 2005.[4]

Overview

Subaru is a Ritchey-Chretien reflecting telescope. Instruments can be mounted at a Cassegrain focus below the primary mirror, in enclosures on either of two Nasmyth focal points on the sides of the telescope mount, to which light can be directed with a tertiary mirror, or, in an arrangement rare on large telescopes, at the prime focus, in lieu of a secondary mirror, to provide a wide field of view suited to deep wide-field surveys.[5]

In 1984, the University of Tokyo formed an engineering working group to study the concept of a 7.5-metre telescope. In 1985, the astronomy committee of Japan's science council gave top priority to the development of a "Japan National Large Telescope" (JNLT), and in 1986, the University of Tokyo signed an agreement with the University of Hawaii to build the telescope in Hawaii. In 1988, the National Astronomical Observatory of Japan was formed through a reorganization of the University's Tokyo Astronomical Observatory, to oversee the JNLT and other large national astronomy projects.[3]

Construction of the telescope began in April 1991, and later that year, a public contest gave the telescope its official name, "Subaru Telescope." Construction was completed in 1998, and the first scientific images were taken in January 1999.[6] In September 1999, Princess Sayako of Japan dedicated the telescope.[7]

A number of state-of-the-art technologies were worked into the telescope. For example, 261 computer-controlled actuators press the main mirror from the back to correct its distortion when the telescope changes its orientation. The telescope enclosure building is also shaped to minimize air turbulence, to improve the quality of astronomical images.

Subaru is one of the few state-of-the-art telescopes to have ever been used with the naked eye. For the dedication, an eyepiece was constructed so that Princess Sayako could look through it directly. It was enjoyed by the staff for a few nights until it was replaced with the much more sensitive working instruments.[8]

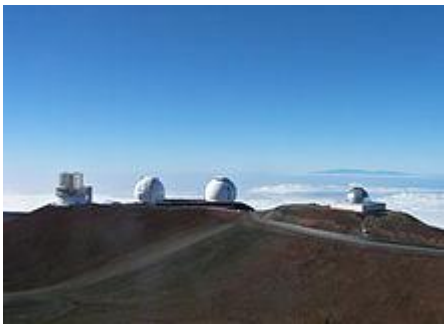
Accidents during construction

Two separate incidents claimed the lives of four workers during the construction of the telescope. On October 13, 1993, 42-year-old Paul F. Lawrence was fatally injured when a forklift tipped over onto him. On January 16, 1996, sparks from a welder ignited insulation which smoldered, generating noxious smoke that killed Marvin Arruda, 52, Ricky Del Rosario, 38, and Warren K. "Kip" Kaleo, 36, and sent twenty-six other workers to the hospital in Hilo. All four workers are memorialized by a plaque outside the base of the telescope dome and a sign posted temporarily each January along the Mauna Kea access road.[9]

Mishap in 2011

On July 2, 2011, the telescope operator in Hilo noted an anomaly from the top unit of the telescope. Upon further examination, coolant from the top unit was found to have leaked over the primary mirror and other parts of the telescope.[10] Observation using Nasmyth foci resumed on July 22, and Cassegrain focus resumed on August 26.[11]

Instruments



The Subaru alongside the twin Keck telescopes and the Infrared Telescope Facility

Several cameras and spectrographs can be mounted at Subaru Telescope's four focal points for observations in visible and infrared wavelengths.

Multi-Object Infrared Camera and Spectrograph (MOIRCS)
: Wide-field camera and spectrograph with the ability to take spectra of multiple objects simultaneously, mounts on the Cassegrain focus.

Infrared Camera and Spectrograph (IRCS)
: Used in conjunction with the new 188-element adaptive optics unit (AO188), mounted at the infrared Nasmyth focus.

Cooled Mid Infrared Camera and Spectrometer (COMICS)
: Mid-infrared camera and spectrometer with the ability to study cool interstellar dust, mounts on the Cassegrain focus.

Faint Object Camera And Spectrograph (FOCAS)
: Visible-light camera and spectrograph with the ability to take spectra of up to 100 objects simultaneously, mounts on the Cassegrain focus.

Subaru Prime Focus Camera (Suprime-Cam)
: 80-megapixel wide-field visible-light camera, mounts at the prime focus.

High Dispersion Spectrograph (HDS)
: Visible-light spectrograph mounted at the optical Nasmyth focus.

Fiber Multi Object Spectrograph (FMOS)
: Infrared spectrograph using movable fiber optics to take spectra of up to 400 objects simultaneously. Mounts at the prime focus.

High-Contrast Coronographic Imager for Adaptive Optics (HiCIAO)
: Infrared camera for hunting planets around other stars. Used with AO188, mounted at the infrared Nasmyth focus.

Hyper Suprime-Cam, a 900-megapixel ultra-wide-field camera, is being built as of late 2011, with first light planned for the end of January 2012 [12]. The extremely large wide-field correction optics (a seven-element lens with some elements up to a metre in diameter) was manufactured by Canon and delivered March 29 2011 [13]. It will be used for surveys of weak lensing to determine dark matter distribution.

...United States Naval Observatory...

Array for Microwave Background Anisotropy (AMiBA)

AMiBA during construction in 2006

Location	Mauna Loa, Hawaii
Coordinates	19°32′10.3″N 155°34′31″WCoordinates: 19°32′10.3″N 155°34′31″W
Altitude	3,396 m
Wavelength	3 mm (86–102 GHz)
Built	2000–2006
First light	September 2006
Telescope style	Interferometer
Diameter	0.576 m
Angular resolution	6 arcminutes (AMiBA7); 2 arcminutes (AMiBA13)
Mounting	Hexapod platform
Dome	Retractable shelter
Website	amiba.asiaa.sinica.edu.tw

The **Yuan-Tseh Lee Array for Microwave Background Anisotropy**, also known as the **Array for Microwave Background Anisotropy** (**AMiBA**), is a radio telescope designed to observe the cosmic microwave background and the Sunyaev-Zel'dovich effect in clusters of galaxies. It is located on Mauna Loa in Hawaii, at 3,396 m above sea level.

AMiBA is currently configured as a 7-element interferometer atop a hexapod mount. Observations at a wavelength of 3 mm (86–102 GHz) started in October 2006, and the detections of six clusters by the Sunyaev-Zel'dovich effect were announced in 2008. The telescope will be upgraded to 13 elements by early 2009[*dated info*] and is expandable up to 19 elements. AMiBA is the result of a collaboration between the Academia Sinica Institute of Astronomy and Astrophysics, the National Taiwan University and the Australia Telescope National Facility, and also involves researchers from other universities.

Design

The rear of the hexapod mount

AMiBA is currently configured as a 7-element interferometer, using 0.576 m Cassegrain dishes mounted on a 6 m carbon fibre hexapod mount. It is located on Mauna Loa, Hawaii, and observes at 3 mm (86–102 GHz) to minimize foregrounds. The telescope has a retractable shelter, made from seven steel trusses and PVC fabric.[1]

The receivers are based on Monolithic Microwave Integrated Circuit (MMIC) technology, with low noise amplifiers cooled to 15 K, which have 20 GHz bandwidths[1] and provide 46 dB of amplification.[2] The signals are mixed with a local oscillator to reduce their frequency, prior to correlation with an analog correlator. The system temperatures are between 55 and 75 K.[1]

AMiBA started in 2000, with funding for 4 years from the Cosmology and Particle Astrophysics Project of the Taiwan Ministry of Education.[3] A 2-element prototype was set up on Mauna Loa in 2002.[2] Further funding for a second 4 years was provided by the National Science Council.[3] The mount arrived on site in 2004, and the platform was installed in 2005. The first 7 elements were then installed ("AMiBA7"), and the telescope's first light was in September 2006, observing Jupiter. The telescope was dedicated in October 2006 to Yuan-Tseh Lee. The array will be upgraded to have thirteen 1.2 m dishes by early 2009 ("AMiBA13").[1][*dated info*] It is expandable up to 19 elements.[2]

Observations

The primary goal of AMiBA is to observe both the temperature and polarization anisotropies in the Cosmic Microwave Background at multipoles between 800 and 8,000 (corresponding to between 2 and 20 arcminutes on the sky), as well as observing the thermal Sunyaev-Zel'dovich effect in clusters of galaxies,[1] which has a maximum decrement around 100 GHz.[2] In its initial configuration, it measures up to multipoles of 3,000[1] with a resolution of around 6 arcminutes.[4] The telescope only observes at night during good weather, using planets for calibration.[2]

Six clusters were imaged in 2007: the Abell clusters 1689, 1995, 2142, 2163, 2261 and 2390,[1] which have redshifts between 0.091 and 0.322.[2] For the largest and brightest four of these—Abell 1689, 2261, 2142 and 2390—comparisons were made with X-ray and Subaru weak lensing data to study the cluster layout and radial properties, specifically of the mass profiles and baryon content.[4] It is predicted that AMiBA with either 13 or 19 elements will be able to detect around 80 clusters per year via the SZ effect.[3]

Collaboration

AMiBA is the result of a collaboration between the Academia Sinica Institute of Astronomy and Astrophysics, the National Taiwan University and the Australia Telescope National Facility. It also involves researchers from the Harvard-Smithsonian Center for Astrophysics, the National Radio Astronomy Observatory, the University of Hawaii, the University of Bristol, Nottingham Trent University, the Canadian Institute for Theoretical Astrophysics and the Carnegie-Mellon University.[1]

List of astronomical observatories

Space observatory

Gravitational-wave detector

Antimatter observatory

Airborne observatory

Radio observatory

Microwave observatory

Ground-based observatory

Solar observatory

Neutrino detector

Cosmic-ray observatory

This is a **list of astronomical observatories** ordered by name, along with initial dates of operation (where an accurate date is available) and location. The list also includes a final year of operation for many observatories that are no longer in operation. While other sciences, such as volcanology and meteorology, also use facilities called observatories for research and observations, this list is limited to observatories that are used to observe celestial objects.

Astronomical observatories are mainly divided into four categories: space based, airborne, ground based and underground based.

Many modern telescopes and observatories are located in space to observe astronomical objects in wavelengths of the electromagnetic spectrum that cannot penetrate the Earth's atmosphere (such as ultraviolet radiation, X-rays, and gamma rays) and are thus impossible to observe using ground-based telescopes.[1] Being above the atmosphere, these space observatories can also avoid the effects of atmospheric turbulence that plague ground based telescopes, although new generations of adaptive optics telescopes have since then dramatically improve the situation on the ground. The space high vacuum environment also allow to free the detectors from the ancestral diurnal cycle due to the atmospheric blue light background of the sky, therefore increasing significantly the observation time.

An intermediate variant is the airborne observatory, specialised in the infrared wavelengths of the EM spectrum, that conduct observations above the part of the atmosphere containing water vapor that absorbs them, in the stratosphere.

Historically, astronomical observatories consisted generally in a building or group of buildings where observations of astronomical objects such as sunspots, planets, asteroids, comets, stars, nebulae, and galaxies in the visible wavelengths of the electromagnetic spectrum were conducted. At first, for millennia, astronomical observations have been made with naked eyes. Then with the discovery of optics, with the help of different types of refractor telescopes and later with reflector telescopes. Their use allowed to dramatically increase both the collecting power and limit of resolution, thus the brightness, level of detail and apparent angular size of distant celestial objects allowing them to be better studied and understood. Following the development of modern physics, new ground based facilities have been constructed to conduct research in the radio and microwave wavelengths of the electromagnetic spectrum, with radio telescopes and dedicated microwave telescopes.

Modern astrophysics has extended the field of study of celestial bodies to non electromagnetic vectors, such as neutrinos, neutrons and cosmic-rays or gravitational waves. Thus new types of observatories have been developed. Interferometers are at the core of gravitational wave detectors. In order to limit the natural or artificial background noise, most particle detector based observatories are built deep underground.

...Observatory in Hawaii...

The **Haleakala Observatory** on the island of Maui, also known as the **Haleakala High Altitude Observatory Site**, is the location of Hawaii's first astronomical research observatory.[1] It is owned by the Institute for Astronomy of the University of Hawai'i, which operates some of the facilities on the site and leases portions to other organizations. Tenants include the Air Force Research Laboratory (AFRL) and the Las Cumbres Observatory Global Telescope Network (LCOGTN). At over 3,050 meters (10,010 ft) in altitude, the summit of Haleakala is above one third of the Earth's atmosphere and has excellent astronomical seeing conditions.[2]

Facilities

Mees Solar Observatory

The Mees Solar Observatory (MSO) is named after Kenneth Mees and dedicated in 1964.[1] It consists of one dome with multiple instruments sharing a common mount.[3]

Pan-STARRS

The Panoramic Survey Telescope and Rapid Response System (Pan-STARRS) is a planned array of telescopes plus a computing facility that will survey the sky on a continual basis, and provide accurate astrometry and photometry of detected objects. By detecting any differences from previous observations of the same areas of the sky, it is expected to discover a very large number of new asteroids, comets, variable stars and other celestial objects. Currently, the 1.8 m (71 in) PS1 prototype telescope is in operation and the PS2 is under construction.[4]

Faulkes Telescope North

The Faulkes Telescope North, part of the Faulkes Telescope Project, is a 2 m (79 in) reflecting telescope owned and operated by the Las Cumbres Observatory Global Telescope Network. It provides remote access to a research-quality telescope primarily to students in the United Kingdom.[5]

TLRS-4 Laser Ranging System

The TLRS-4 Laser Ranging System is part of the International Laser Ranging Service (ILRS), which provides satellite laser ranging and lunar laser ranging data.[6] The TLRS-4 replaced an older facility in order to provide continuity of data. The old facility now houses telescopes of the Pan-STARRS project.[7]

Zodiacal Light Observatory

The Zodiacal Light Observatory currently consists of two instruments. The Scatter-free Observatory for Limb Active Regions and Coronae (SOLARC or SOLAR-C) telescope is a 0.5 m (20 in) off-axis reflecting coronagraph that is used to study the Sun's corona.[8] The Day-Night Seeing Monitor Telescope System (DNSM) makes telescope-independent observations of perturbations in the atmosphere above Haleakala.[9]

Maui Space Surveillance Complex

The Air Force Office of Scientific Research (AFOSR) of the Air Force Research Laboratory (AFRL) operates the Maui Space Surveillance Complex (MSSC), which is part of the Air Force Maui Optical and Supercomputing Site (AMOS). Located at the MSSC are the 3.67 m (144 in) Advanced Electro Optical System Telescope (AEOS),[10] the Maui Space Surveillance System (MSSS), and the Ground-based Electro-Optical Deep Space Surveillance (GEODSS). The MSSS uses a number of optical assets, including a 1.6 m (63 in) telescope, two 1.2 m (47 in) telescopes on a common mount, a 0.8 m (31 in) beam director/tracker, and a 0.6 m (24 in) laser beam director.[11] The GEODSS uses two 1.0 m (39 in) telescopes and one 0.38 m (15 in) telescope.[12]

Future facilities

- The Advanced Technology Solar Telescope (ATST) is a proposed 4.0 m (160 in) solar telescope.[13] It will be owned and operated by the National Solar Observatory.[14]
- The AFRL has plans to build a mirror re-coating facility adjacent to the AEOS building.[12]

Former facilities

- A Baker-Nunn telescope operated from 1957 to 1976 as part of Project Space Track.[15]
- The Lunar Ranging Experiment (LURE) Observatory operated from 1974 until 1994.[15] The Pan-STARRS PS1 now resides in the south dome of the LURE facility and the PS2 is being built in the north dome.
- The University of Chicago Enrico Fermi Institute operated the Haleakala Cosmic Ray Neutron Monitor Station from 1991 to 2007.[15][16]
- The Haleakala Gamma Ray Observatory was a six-mirror Imaging Atmospheric Cherenkov Telescope on a equatorial mount. It began operating in 1981 and was upgraded in 1988.
- The Multicolor Active Galactic Nuclei Monitoring (MAGNUM) was a 2.0 m (79 in) near infrared telescope operated by the University of Tokyo.[17] It was housed in the LURE facility's north dome from 1998 to 2008.[15]
- Observations of airglow were made from a platform near the middle of the site in the 1960s and 1970s. The platform is now used for temporary projects.[12]
- The Near-Earth Asteroid Tracking (NEAT) program operated from 2000 to 2007 using one of the MSSS 1.2 m telescopes.

Non-astronomical facilities

- The Federal Aviation Administration operates a facility immediately to the west of the observatory site.[15]
- The Department of Energy also operates a facility immediately to the west of the observatory site.[15]
- A small building on the site is used by the Haleakala Amateur Astronomers.[15]

The United States Naval Observatory is a shore activity under the command of the Superintendent, U.S. Naval Observatory and the Commander, Naval Meteorology and Oceanography Command.

After nearly fifty years at the site on the Potomac River, hampered by fog and deteriorating buildings, in 1893 the U.S. Naval Observatory moved to its present location on Massachusetts Avenue in Northwest Washington, D.C. At that time the site was well outside the city, and separated from it by a deep valley. Three of the buildings (the main building, the 26-inch dome and the transit circle buildings) were designed by the renowned architect Richard Morris Hunt. The Superintendent's residence, located to the north of the Observatory's main building, was also completed at this time. It was designed by Leon Dessez. (In 1929 the Superintendent's residence became the home of the Chief of Naval Operations, and in 1974 Congress designated it as the Temporary Official Residence of the Vice President of the United States.)

As an event that provided an opportunity to rethink old programs and to propose new ones, as well as in the provision of new facilities, the move to the new location was an important landmark in the history of the Observatory. Along with new programs such as the daily monitoring of solar activity with a photoheliograph (1899-1971), the old functions of timekeeping and meridian and equatorial observations were kept intact. The move also provided

the occasion for the Nautical Almanac Office, in Cambridge, Massachusetts since 1849 and located in Washington, D.C. since 1866, to become officially a part of the Naval Observatory.

The challenge was now to achieve greater and greater accuracy in all areas of its mission, a quest that characterizes much of the research at the U.S. Naval Observatory during the twentieth century. Greater accuracy required improved technology, and nowhere was this more evident than in the determination, maintenance and dissemination of time. Beginning in 1934, the Observatory determined time with a photographic zenith tube (PZT), a specialized instrument that points straight upward toward the zenith and automatically photographs selected stars crossing the zenith. This gave a measure of the Greenwich Mean Time (now called Universal Time), the "time of day" based on the rotation of the Earth. Improvements in clock technology, including the Shortt free-pendulum clock and quartz crystal clocks, soon proved conclusively that the Earth's rotation was not uniform, and a new uniform time scale known as Ephemeris time came into use in 1956.

Defined by the orbital motion of the Earth about the Sun, in practice Ephemeris time was determined by observations of the Moon, first undertaken with the dual rate moon camera, invented by William Markowitz at the Naval Observatory in 1951. In 1984 the family of time scales known as dynamical time replaced Ephemeris time as the time based on the motion of celestial bodies according to the theory of gravitation, now taking relativistic effects into account. In the meantime, the development of atomic clocks brought about the introduction of a much more accessible time - the Atomic time scale based on the vibration (an energy level transition) of the cesium atom.

In 1958 the Naval Observatory and Britain's National Physical Laboratory published the results of joint experiments that defined the relation between Atomic time and Ephemeris time. (An interesting scientific and philosophical question is whether the relationship between Atomic time and gravitational time remains constant.) Since 1967 the international definition of the second has been based on these joint experiments. Atomic time is kept synchronized with universal time by the addition or subtraction of a leap second whenever necessary.

Time dissemination has also been continuously improved. In 1904 a naval radio station transmitted the first radio time signals ever; they were derived from a U.S. Naval Observatory clock. This was the beginning of a system of radio time, constantly improved and increasingly automated through the century, that now spans the globe. The function of rating, repairing and disseminating chronometers and other nautical instruments, a major and especially critical effort during World War II , was transferred from the Observatory to the Optical Section of the Norfolk Naval Shipyard in Portsmouth, Virginia in 1950.

The determination of the fundamental celestial coordinate system, against which the motions of all other celestial bodies must be measured, has been carried out during this century at the U.S. Naval Observatory by two transit circle telescopes, the nine-inch (operated from 1894 to 1945) and the six-inch, designed by William Harkness and mounted in 1899. The catalogues produced by these instruments are fundamental in the sense that in addition to selected stars, observations are also made of the Sun, Moon, planets and asteroids. These solar system objects are used to determine the positions of the equator and equinox, which define the orientation of the

fundamental celestial coordinate system. The six-inch transit circle has produced six fundamental star catalogues since 1924. This instrument has undergone many changes in technology to improve accuracy, from the method of reading its graduated circle, to a traveling-wire micrometer, digital readouts of the micrometer measures, and computerized data acquisition and telescope control. In 1956 a new seven-inch transit circle was installed to replace the nine-inch. During the late 1960s and early 1970s it was located in El Leoncito, Argentina, for a program of Southern hemisphere observations; after an intensive development program, it was moved to the South Island of New Zealand in 1984.

The quest for greater accuracy with the equatorial telescopes has been carried out by improvements to the 26-inch, as well as by the addition of new specialized telescopes. In 1935 a 40-inch Ritchey-Chretien aplanatic reflecting telescope, one of the first of its kind, was completed by G.W. Ritchey, a pioneer in telescope design who spent four years at the Naval Observatory on this project. (The Hubble Space Telescope is of this design.) This telescope was moved to the newly-established Flagstaff station in Arizona in 1955, and was joined in 1963 by a new 61-inch astrometric reflector, designed and constructed under the direction of Naval Observatory Scientific Director Kaj Strand.

Again, the 61-inch is a pioneering design: the first, the biggest and the most accurate of its kind ever built. Together, the 40-inch and the 61-inch determine the relative positions, brightness, colors, and spectral types of stars with electronic cameras, and by photography and photometry. The 61-inch, which has a focal length of 50 feet, has, since its inception, carried out the world's largest program of determining stellar parallaxes; that is, accurate determinations of distances of nearby stars. For the first 20 years of its existence it has concentrated on stars with magnitudes ranging from 12 to 18. For this program 35 to 40 photographic plates were taken of each star, and the plates were measured with an automatic measuring engine in Washington, the main parts of which are made of massive blocks of granite, and which can determine star positions on photographs to better than one micron.

The 61-inch reflector, together with an eight-inch double astrograph and a 15-inch astrograph, has also been involved in a program on the astrometry of solar system objects. It was with photographs taken with the 61-inch for this program that James W. Christy discovered a satellite of Pluto in 1978, 101 years after Asaph Hall discovered the moons of Mars. That discovery resulted in a precise determination of the mass of Pluto, and raised new speculations about the possibility of a planet beyond Pluto. In the meantime, the 26-inch, the old classical refractor, was engaged throughout the century in a program to observe natural satellites and double stars; almost 30,000 visual measures of double stars were made in this program between 1961 and 1990. Since 1990 double stars have been observed with a technique known as "speckle interferometry". By taking very short exposures with a Charge-Coupled Device (CCD) camera, astronomers can actually use the blurring effect of Earth's atmosphere to their advantage to measure the separations and position angles of double star components. The technique is ideally suited to the 129 year-old optics of the great telescope, and relatively unaffected by the urban location of the Observatory. Several thousand stars are measured annually, and the database of such observations, added to the visual observations dating back over a century, provide for one of the most concise double star catalogs in the world.

Throughout the century, the Nautical Almanac Office has fulfilled its essential function of predicting the positions of celestial bodies. Utilizing transit circle observations from the U.S. Naval Observatory and around the world, the Nautical Almanac Office has improved the theories of the orbital motions of solar system objects. These theories were used to construct ephemerides for astronomers, navigators, and surveyors, printed for most of the century as *The American Ephemeris and Nautical Almanac*, but since 1981 as *The Astronomical Almanac*. For marine navigation there is a separate publication, *The Nautical Almanac*. For the use of air navigators during World War II the Nautical Almanac Office designed and developed the *American Air Almanac*, first issued in 1941, and still issued as *The Air Almanac*. Since the beginning of World War II the Nautical Almanac Office has been in the forefront of the development and utilization of computerized techniques in astronomy. This is necessary not only for the production of the Almanacs, and for providing astronomical data of various types for locations worldwide, but also for a wide range of research in celestial mechanics carried out at the Nautical Almanac Office.

The Observatory Today

The U.S. Naval Observatory continues to be the leading authority in the United States for astronomical and timing data required for such purposes as navigation at sea, on land, and in space, as well as for civil affairs and legal matters. Its current Mission Statement, promulgated in 1984 by the Chief of Naval Operations, reads:

"To determine the positions and motions of celestial bodies, the motions of the Earth, and precise time. To provide the astronomical and timing data required by the Navy and other components of the Department of Defense for navigation, precise positioning, and command, control, and communications. To make these data available to other government agencies and to the general public. To conduct relevant research; and to perform such other functions or tasks as may be directed by higher authority."

The U.S. Naval Observatory, via its Directorates for Astrometry and Time, carries out its primary functions by making regular observations of the Sun, Moon, planets, selected stars, and other celestial bodies to determine their positions and motions; by deriving precise time interval (frequency), both atomic and astronomical, and managing the distribution of precise time by means of timed navigation and communication transmissions; and by deriving, publishing, and distributing the astronomical data required for accurate navigation, operational support, and fundamental positional astronomy. The U.S. Naval Observatory conducts the research necessary to improve both the accuracy and the methods of determining and providing astronomical and timing data.

In addition to its Washington, DC, headquarters, the U.S. Naval Observatory maintains several field activities. The Time Service Alternate Master Clock Station at Schriever Air Force Base in Colorado serves as a backup to the Master Clock system in Washington, D.C. The Flagstaff Station provides a dark sky site at Flagstaff, Arizona, where the 61-inch astrometric reflector, the 40-inch reflector, a 24-inch reflector, and an 8-inch transit circle telescope are located. An 8-inch astrograph, formerly stationed in Washington, has completed a complete CCD survey of the entire sky from the Cerro Tololo Inter-American Observatory (CTIO) in Chile and Flagstaff,

which is now available as the USNO CCD Astrograhic Catalog (UCAC). It is currently undergoing a complete renovation for the installation of a new 400 megapixel CCD/CMOS hybrid camera. This instrument will be deployed at Flagstaff and Cerro Tololo and will be remotely operated for the compilation of the follow-on to the UCAC.

The transit circle telescopes have now completed their historic mission of determining the fundamental celestial coordinate system. In their place the Navy Prototype Optical Interferometer (NPOI) has been constructed at Anderson Mesa near Flagstaff, Arizona. It is a new generation synthetic aperture telescope that will precisely determine the positions of stars to accuracies 100 times better than conventional ground-based techniques, thus providing the necessary reference points for precise guidance and targeting systems, as well as for a variety of astronomical purposes. It consists of two arrays of mirrors, which gather the starlight, which is then combined in such a way that the interference patterns of the waves yield valuable scientific information. The first array, using four fixed mirrors arranged in a Y shape along 20-meter arms, will produce astrometric data, while the second array, using six mirrors movable along the arms of a 250-meter Y, will be used for imaging objects. The astrometric array and the inner part of the imaging array will be completed in late 1995. By 1998 the imaging array was extended to its full size.

The Flagstaff station is at the forefront of electronic techniques in astronomy, using charge-coupled device (CCD) cameras, to measure relative positions of stars and other objects. Accurate stellar colors need to be taken into account in position determination, and are measured at the Flagstaff station. The U. S. Naval Observatory Precision Measuring Microdensitometer (PMM) is being used here to digitize approximately 5000 photographic plates from the Palomar Observatory Sky Surveys I and II. This program will result in a new star catalogue with a billion objects. The Flagstaff station is also working in the field of infrared astronomy, where the sky appears quite different than at optical wavelengths

Highly accurate Earth orientation (rotation rate and polar motion) determinations are now made using radio telescopes that track quasars, powerful sources of radio energy some five to fifteen billion light-years distant. To accomplish this, the Very Long Baseline Interferometry (VLBI) system is used. The VLBI system regularly uses telescopes at the National Radio Astronomy Observatory in Green Bank, West Virginia, as well as sites in Alaska and Hawaii. The VLBI correlator needed to analyze these observations is located at the U.S. Naval Observatory in Washington, D.C. The extragalactic reference frame produced by these observations is now the most accurate celestial coordinate system. Future DoD needs for USNO Earth Orientation information include a GPS requirement for long-range predictions of the Earth's rotation with an error of 3 meters.

By a Department of Defense directive, the U.S. Naval Observatory is charged with maintaining the DoD reference standard for Precise Time and Time Interval (PTTI). The Superintendent is designated as the DoD PTTI Manager. The U.S. Naval Observatory has developed the world's most accurate atomic clock system, accurate to a billionth of a second per day. Increasingly accurate and reliable time information is required in many aspects of military operations. Modern navigation systems depend on the availability and synchronization of highly accurate clocks. This holds for such ground-based systems as LORAN-C as well as for the Department of

Defense satellite-based Global Positioning System (GPS). In the communications and the intelligence fields, time synchronized activities are essential. The U.S. Naval Observatory Master Clock is the time and frequency standard for all of these systems. Thus, that clock system must be at least one step ahead of the demands made on its accuracy, and developments planned for the years ahead must be anticipated and supported.

The Master Clock system now incorporates hydrogen masers, which in the short term are more stable than cesium beam atomic clocks, and mercury ion frequency standards, which are more stable in the long run. These represent the most advanced technologies available to date. In the past highly accurate portable atomic clocks have been transported aboard aircraft in order to synchronize the time at Naval Bases and other Department of Defense facilities around the world with the Master Clock. Accurate time synchronization with the Master Clock is now carried out through two way satellite time transfer, or through the use of atomic clocks on GPS satellites, which provide the primary means of time synchronization and worldwide time distribution.

In the production of the Astronomical, Air, and Nautical Almanacs, the U.S. Naval Observatory must accurately predict the positions of stars and planets for several years in the future. In the case of the planets, this prediction requires a very precise knowledge of their orbits, and involves a research effort of formidable magnitude, requiring some of the most accurate mathematical calculations made in any field of science. The planets in turn, through their gravitational force, have an influence on the motion of the Earth, and therefore precise knowledge of planetary masses and positions is essential to accurately predict the future positions of the Earth in space, its motion and orientation. The Astronomical Applications Department, which undertakes this work, also distributes astronomical data by computer. In the past this led to the development of the Almanac for Computers and the Floppy Almanac, both of which have now been superseded by the Multiyear Interactive Computer Almanac (MICA), a 250-year computer-based almanac available for both Windows- and MacOS-based operating systems. A computerized celestial navigation package, known as STELLA (System to Evaluate Latitude and Longitude Astrometrically), is now available to DoD clients. It is important to remember that in the event of war, celestial navigation cannot be jammed.

The increasing demands of the Navy and other components of the Department of Defense for more accurate astronomical and timing data require a continuing, intense effort by the U.S. Naval Observatory in order to adequately carry out its unique mission. The U.S. Naval Observatory, the realization of John Quincy Adams' vision of an American "Lighthouse of the Sky", remains today at the leading edge of technology for astrometric and timing data, and is an institution of which the U.S. Navy is justifiably proud.

Caltech Submillimeter Observatory

The Caltech Submillimeter Observatory on Mauna Kea.

Organization	California Institute of Technology
Location	Mauna Kea
Coordinates	19.82250°N 155.47585°WCoordinates: 19.82250°N 155.47585°W
Altitude	13,300 ft
Wavelength	1300 to 350 microns
Built	1985
First light	1986
Diameter	10.4
Website	http://www.submm.caltech.edu/cso/

The **Caltech Submillimeter Observatory** (**CSO**) is a 10.4-metre (34 ft) diameter submillimeter wavelength telescope situated alongside the 15-metre (49 ft) James Clerk Maxwell Telescope (JCMT) at Mauna Kea Observatory. It is engaged in submillimeter astronomy, of the terahertz radiation band.

The CSO and JCMT were combined to form the first submillimeter interferometer. The success of this experiment was important in pushing ahead the construction of the Submillimeter Array and the Atacama Large Millimeter Array interferometers.

On April 30, 2009, Caltech announced plans to decommission the CSO, transferring ongoing research to the next-generation Cerro Chajnantor Atacama Telescope (CCAT) in Chile. The plans call for CSO to be dismantled beginning in 2016, with its site returned to a natural state by 2018.[1]

Kobe University...

Directions

geocities.jp

Kobe University, also known in the Kansai region as Shindai, is a leading national university located in Kobe, Hyōgo, Japan. Wikipedia

Address: 1 - 1 Rokkodaicho, Nada Ward, Kobe, Hyogo Prefecture 657-0013, Japan
Phone: 078-881-1212
Enrollment: 16,730 (2011)
Founded: 1949

Kobe University

Kobe University

神戸大学

Motto	None
Established	1949
Type	Public (National)
Endowment	US$226 million

	(JP¥25,952 million)
	Hideki Fukuda
President	
	town = Kobe
Academic staff	1,436
Admin. staff	1,241
Undergraduates	11,887
Postgraduates	4,957
Location	, Hyōgo, Japan
Nickname	None
Mascot	None
Website	http://www.kobe-u.ac.jp/

Kobe University (神戸大学 *Kōbe daigaku*[?]), also known in the Kansai region as *Shindai* (神大[?]), is a leading national university located in Kobe, Hyōgo, Japan.

It was established in 1949,but the academic origins of Kobe University trace back to the establishment of **Kobe Higher Commercial School in 1902**, which was renamed as **Kobe University of Commerce**, and **Kobe University of Economics**.

Kobe University comprises 14 graduate schools and 11 undergraduate faculties. The university holds a total of about 16,000 students enrolled in undergraduate and graduate programs. The institution welcomes oversea students, which accounted for a total of 1,108 students, as of 2011. It also has 3,300 staff members, including professors, associate professors and administrative officials.

Located beside the foothills of Mount Rokkō, the university provides a view of the city and port of Kobe, providing an environment for the pursuit of academic studies, especially social science areas. Kobe University is one of the oldest and largest national universities in Japan.

History

The roots of the university can be traced back to 1902, when the **Kobe Higher Commercial School** (神戸高等商業学校 *Kōbe kōtō shōgyō gakkō*?) was established. Its first president was Tetsuya Mizushima (水島銕也?, 1864—1928). In 1929 this school was renamed **Kobe University of Commerce** (神戸商業大学 *Kōbe shōgyō daigaku*?), and it was further renamed in 1944, **Kobe University of Economics** (神戸経済大学 *Kōbe keizai daigaku*?).

In 1949, under Japan's new educational systems, the university was merged with Hyogo Normal School, Hyogo Junior Normal School, Kobe Technical College and Himeji High School, all of which were in Hyōgo Prefecture, leading to the creation of *Kobe University*.

The school's President was on her period, the university has been expanded and has created new faculties to complement its main academic foundations, which is economics and commerce.

Campuses

Rokkodai main building

The university is formed by four campuses: Rokkodai, Kusunoki, Myodani, and Fukae. Rokkodai Campus is considered the main campus, and it comprises nine out of eleven faculties.

Kobe University....connections to Hawaii observatory

- **Department of Earth and Planetary sciences**
- **Cosmo and Geochemistry Laboratory**
- **Planetary material science Laboratory**
- **Solar System Physics Laboratory**

Tip : NASA Astrobiology Institute, *University* of *Hawai*'i lead team, Honolulu, *HI* USA. Research Fellow **...** Caltech Submillimeter *Observatory* (sub-mm). Computer **...** in Space, *Kobe*, Japan, 2009. **....** From KBOs to Centaurs: The thermal *connection*.

IBM to develop supercomputer to unravel Universe

International Business Machines Corp (IBM) has partnered with a team building the world's largest radio telescope to develop super computer systems to make sense of light years of space data and the history of the universe.

The Netherlands Institute for Radio Astronomy, known as ASTRON, and IBM will collaborate to research so-called exascale computers that consume little power. The technology will be needed to study faint radio signals from deep space produced by the "Big Bang" 13 billion years ago -- to be collected by the Square Kilometre Array telescope when it's completed in 2024.

"The telescope will be used to explore evolving galaxies, dark matter and even the very origins of the universe," IBM and ASTRON said in a statement. "Scientists estimate that the processing power required to operate the telescope will be equal to several millions of today's fastest computers."

The initial five-year, 32.9 million euro ($43.9 million) "DOME project" in Drenthe, the Netherlands, will investigate technologies necessary to read, store and analyze one exabyte of raw data per day -- twice today's entire daily Internet traffic. IBM, the world's biggest computer-services provider, is advancing technologies that increase memory capacity and reduce power consumption to process near-limitless data, to help business and government clients analyze performance and project trends.

'

Futuristic technology'

"We have to invent futuristic technology to look into the past," Ronald Luujten, IBM's lead researcher on the project in Zurich, Switzerland, said in an interview. "The energy issue is becoming ubiquitous. We need fundamental new technologies to deal with the needs of the future data centers."
The 1.5 billion euro telescope project is "comparable" in size, cost and international participation to the Large Hadron Collider developed by CERN, the European Organization for Nuclear Research, said Luujten. The collider is looking for the "same answers" as the telescope, by smashing protons together inside its particle accelerator, creating what Luujten called "mini Big Bangs."

Construction of the super telescope will begin in 2017. It will be positioned in Australia or South Africa where there is enough space to accommodate 3,000 dishes -- one square kilometers' worth of antenna positioned across a continent, that make up the super telescope, said Luujten.

IBM, based in Armonk, New York, has partnered with governments and universities in both potential host countries to develop software that will filter out "the noise" the telescope collects and create sky maps for astronomers.

...Two killed in fire at Antarctic base...

FIRE AND ICE: Brazil's Comandante Ferraz Antarctic station during the blaze that killed two people.

A fire broke out at Brazil's research station in Antarctica on Saturday (Sunday NZT), killing two navy personnel and forcing the evacuation by helicopter of about 40 other people, the government said.

A third navy member was injured but stable after the fire, which broke out in a building housing power generators at the Comandante Ferraz base, the navy said in a statement. It said those evacuated had been flown to Chile's Antarctica station.

President Dilma Rousseff in a statement offered condolences to the families of the two victims identified as Carlos Alberto Vieira Figueiredo and First Sergeant Roberto Lopes dos Santos and praised the efforts to bring the blaze under control. There was no immediate word on what might have caused the fire.

She said Brazil was also determined to rebuild the base, which is on the continent's King George Island. She called Chilean President Sebastian Pinera to thank him for his country's assistance in the face of the emergency.

Several South American countries have bases in Antarctica where they carry out scientific research, despite concerns among environmentalists over the risks of human activity on the

planet's least populated and most pristine continent. Brazil has had a base in Antarctica since 1984.

The group evacuated from the base would be flown to Punta Arenas in Chile by the Argentine air force, and then back to Brazil in a Brazilian air force plane, Brazil's navy said.

The head of the base and a handful of military personnel who stayed behind to combat the blaze had to be evacuated later to the Chilean base due to bad weather. They will return to evaluate the damage when the weather improves, the navy said.

DIESEL CARGO SINKS

The navy also confirmed on Saturday that a barge shuttling diesel to the base sank in a storm and that a ship was being sent to recover the apparently intact vessel and the fuel. The navy said the fuel had not leaked.

Brazilian newspaper Estado de Sao Paulo said the barge sank in December. The navy press office said it was not immediately able to confirm that information.

The navy statement said the barge sank to a depth of 130 feet (40 metres) while being towed to shore with its cargo of 2600 gallons (10,000 litres), equivalent to 63 barrels. No one was aboard the barge when it sank.

The barge is about 1000 yards (914m) from the shore where Brazil's Comandante Ferraz Antarctica Station is located.

A special ship chartered by Brazilian state-controlled oil company Petrobras will reach the site next week to attempt to haul the barge to the surface with the use of a crane and inflatable bags to be attached to the barge.

The navy said the fuel was "Arctic Diesel" adapted for freezing Antarctic conditions.

PART 3 : CONNECTING THE DOTS...

...Siloe space based platform...

"Secretum Omega Part II"
"Secretum Omega"
by Cristoforo Barbato

(

[B] Let's talk about your tasks on the S.I.V scene.

[J] My tasks were purely technical, the most important of which were , for example, to take extremely secret information coming from a Vatican radio telescope located in Alaska and forward it to respective destinations.

[B] Just a second, but to which radio telescope are you referring? I did not know that the Vatican owned such a structure in that area.

[J] The Vatican owns and utilizes an extremely advanced radio telescope that is in the vanguard of systems and technology and is only used by Jesuits. It is located inside an industrial park used to store petroleum, apparently abandoned, situated in the state of Alaska. This complex is camouflage because officially the activities that go on inside are not those of the VATT in Arizona and are kept "Top Secret."

** **Translator's note:** I have found a HAARP test application that could possibly be used in a search for Nibiru. HAARP is located in Gakona, Alaska. See "Lunar Radar Experiment": http://www.nrl.navy.mil/content.php?P=04REVIEW106

[B] When was that apparatus built and, above all, what end in sight did the Vatican have in owning so many other astronomical sites around the world?

[J] What I can say is that it was built in the 1990s with the object of studying all anomalous celestial bodies approaching Earth, similar to what the CIA did with one of its "secret eyes," the twin to Hubble, called "SkyHole 12" (a.k.a. Keyhole 12… For details see: http://en.wikipedia.org/wiki/KH-12).

Moreover, the S.I.V. was informed during the meetings (of the aliens) with Pope Pius XII of the approach of a celestial body to the solar system in which resides an advanced very warlike alien race. Very shortly, I knew that the material that I should have been receiving in Rome and then analyzing on a computer was very interesting and extremely secret. It was during the analysis of certain data and information from the Alaska radio telescope that we discovered that one remote deep space probe, part of a deep space exploration program called "SILOE", which was started in 1990 had taken a photograph of a huge planet getting closer to the Solar System. The information was received in Alaska during October 1995, which is when my problems started. I discovered that I was not chosen to decode that particular transmission and a dangerous situation evolved. At that time, my contact revealed to me that, inside the Vatican, there were two factions struggle over possession and control of this information, which was classified far beyond "Top Secret."

[B] Can you give me some other details on the space program called SILOE? Who proposed and launched it?

[J] The probe called "SILOE" takes its name from an identically named program of space exploration begun in the early 1990s. Furthermore, regarding this, I can add that this program was part of another one, much wider in scope, named "Kerigma." (Author's note: Regarding the latter ("Kerigma"), nothing was revealed to me.) For now, I can just tell you that this probe was created in Area 51, has an electromagnetic impulse motor, and it was put in orbit by a space plane, like type "Aurora." The probe did not have any calculations or pre-indications of the trajectory or the precise location of "Nibiru," because its purpose was to approach that planet, correcting its direction to avoid impact and to return to this Solar System to a position close enough to transmit the data and images to the secret radio telescope located in Alaska. The probe was launched as soon as the radio telescope was and the probe was capable of transmitting images in 1995.

B] What I am hearing from you reminds me of some theories formulated by researcher, Zechariah Sitchin, regarding the future return of the mysterious 12th planet. Do you know this work?

[J] Yes, I know about the principle aspects. What I can say is that S.I.V. in collaboration with Lockheed Martin launched that probe, which made the images that I later analyzed. These images are of an enormous celestial body whose presence will "felt" within at most 3 years from 2001 in our Solar System.

[B] How did you get access to such information?

[J] Actually, I possess an authorization for the supervision of the so-called "Secretum Omega." This is the highest classification of secrecy in the Vatican, equivalent to "Cosmic Top Secret" in NATO. This is subdivided into 3 levels of information: from the least detailed, Secretum Omega Level III to the Secretum Omega Level I, which is the most complete. My actual goal was to indoctrinate new members of S.I.V., teaching them the use of the communication systems of this organization.

[B] How is the information collected by the radio telescope in Alaska relayed to Italy?

[J] There are some radios and antennas linked to two geostationary satellites over Italy, property of an American telecommunications company, Sprint International, which owns parabolic antennae located in Italy, in the north and in the extreme south. This company has a special contract with the S.I.V. and a private channel broadcasting and receiving enciphered data using private algorithms and personalized cryptography, used since 1994. Before this, the S.I.V. utilized a cryptographic system invented by a Swiss society, which was subsequently abandoned because one of the members of this society sold secretly to some Israelis. I can't give you other technical information at the moment.

[B] I would like to ask you about a well-known religious legate to the Church. I am referring to Monsignor Balducci who publicly spoke about the extraterrestrial themes. Is it possible that Balducci is working in concert with S.I.V.? And that he has knowledge of its existence?
http://www.pufoin.com/pufoin_perspective/et_church.php

[J] Surely Father Balducci made his studies and his research in a totally autonomous manner without following any preexisting established program. During his research, he was never obstructed. On the contrary, in certain ways he was actually encouraged.

[B] Just a moment please, it seems to me understanding your words that there exists a program for disclosure. And, maybe, for this reason could it be that you decided to meet me and reveal this information to me?

[J] We are "crazy splintered", according to the system, but we know that certain events are going to happen to all living beings on the planet; no one is excluded. All humanity in this actual period of history is living in a particular circumstance and intimately linked to some key events contained in the Book of the Apocalypse. The human race must surrender completely to the message of salvation and redemption of Christ, which St. Paul defined as

"Kerigma," a message that John Paul II is trying to spread to all nations. Don't you think that the Pope knows how close these events are to us?

[B] But how much does the Pope know about all this information, also in view of the passionate declaration that he made from this year? (**Author's note:** the year is 2000 specially concerned the official trip to Fatima for solemn beatification of seers Francisco and Jacinta)

[J] Inside the Vatican there are two different groups struggling one against the other with counter positions; one of these promulgates disclosure of this information program and is defended body and soul by Wojtila (Pope John Paul II), the other tried to block any information from getting out by any means, to the point that some members of this faction take part in occult power groups. For example, they control the world oil market, actually working in many international economies with the sole purpose of blocking any disclosure of any alternative free energy sources. Groups like that behind the famous and controversial "The Guardian UFO Case" of which you know, dramatically authenticated this information in great measure with the exception of photographs of presumed alien entities.

Anyway, these documents and information describe a real situation. Reality often surpasses the craziest fantasy. Unfortunately, this is the case. And of all these occult organizations, the apex is the SVS.

Planet X and the "JESUIT FOOTAGE" Classified "SECRETUM OMEGA." First Indirect Confirmation!

by **Luca Scantamburlo**

Cristoforo Barbato speaking about the Secretum Omega. Photo used with his kind permission - www.secretum-omega.com.

After the release of the controversial 'MJ-12' files and of the 'Guardian' files, by an anonymous individual, and perhaps for the first time in history, one member of the ufological community, an Italian freelance writer and investigator, was able to check the credentials of the alleged anonymous insider, an individual that was still working for the intelligence community and had not been fired or retired. This mystery man was responsible for the release of the above classified material. He was an insider of a presumed Vatican intelligence structure and his actions were supported by his colleagues. But first of all, let me tell you something about that freelancer: Cristoforo Barbato.

Born in Naples in 1972, is an Italian independent UFO researcher; in the last 7 years he worked and written for several UFO magazines and frontier studies published in Italy: Notiziario UFO and Dossier

Alieni for example. For many years Barbato was also a member of the C.U.N. (Centro Ufologico Nazionale), the main Italian ufological association. Moreover he has collaborated to the realization of two Italian encyclopedias on the UFOs subject, entitled UFO Dossier X, published by the Fabbri Edizioni and Stargate - Enigmi dal Cosmo, by Curcio Editore. Barbato has also participated as speaker at some national conventions on the UFOs, where he has had the possibility to meet different important UFOs researchers, both Italians and international: among them Col. Philip Corso, U.S. Army retired officer.

For some years Barbato was editor in charge in Rome for some Italian magazines, as Stargate, Extra Terrestrial and Stargate Magazine. During that period he wrote on the magazine "Stargate" many reports about Fatima Apparitions and the famous "Third Secret". After the publication of those reports, precisely in the year 2000, he received several e-mails from a person who qualified himself as a Vatican insider. From those e-mails rose up the story of a presumed Vatican Intelligence Agency, whose code would be S.I.V.: "Servizio Informazioni del Vaticano", which in Italian means "Vatican Information Services". In short the Vatican Secret Services. Barbato, at the beginning, was very skeptical and did not rely on him. After one year of such an epistolary contacts (in the meantime the insider revealed himself as a S.I.V. membership, belonging to the Jesuit Order and working by the Holy See), the Italian freelance demanded a meeting with him, as a necessary condition to carry on the contacts. In spite of the risks the Vatican insider accepted, and I suppose he was aware it was necessary considering his baffling revelations. Two meetings took place in a public space in Rome in 2001. After that at least his identity was clear: he was not a mythomaniac; he was really a Jesuit working by the Holy See. Of course the Italian freelance has been protecting his source, avoiding to spread his name; and very soon Barbato realized that he knew much more than what he had told him by e-mail.

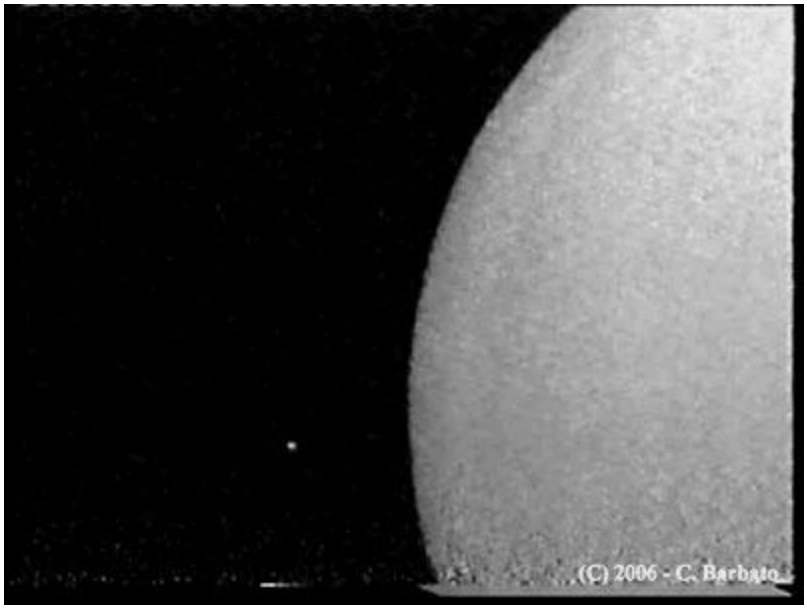
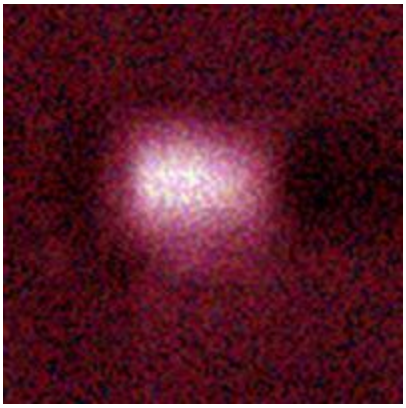


Photo used with the kind permission of Cristoforo Barbato - www.secretum-omega.com.



Closeup of object to the right of Planet X. Object has been enlarged with noise added. Photo used with the kind permission of Cristoforo Barbato - www.secretum-omega.com.

Moreover in 2001 the Vatican insider sent to Cristoforo Barbato by post a videotape (shown for the first time during a meeting that took place in Pescara, in Italy, on 30 April 2005), containing a footage of 2 minutes regarding observations of a planetoid in the deep space (the presumed Tenth Planet, "the Planet X"), while it was approaching to the Solar System. The video, which shows an introduction of writings of classification on it, had been carried out by a secret space probe named "Siloe". The Vatican deep throat told Barbato the space probe was equipped with a sophisticated infrared camera and an electromagnetic impulses propulsion, and was assembled in Area 51(Nevada), and then orbited by an aircraft of the type "Aurora", a secret hypersonic aircraft; the space probe Siloe, always according the Barbato's contact, sent the images of the planetoid in October 1995 (after it came back to the border of Solar System to have more power of signal), to a secret radio telescope hidden in an unused oil-refining plant in Alaska, totally managed by some Jesuits belonging to the S.I.V. The radio telescope, he added, was built in 1990 to observe anomalous celestial bodies on approaching the Solar System.

An unknown spacecraft possibly the Aurora escaping earth's atmosphere. Photo taken during a STS mission. Photo used with the kind permission of Cristoforo Barbato - www.secretum-omega.com.

Closeup of triangle object traveling over earth. Photo used with the kind permission of Cristoforo Barbato - www.secretum-omega.com.

After his conference in Pescara (Italy), Barbato spread a press release which, according to the Jesuit's information, would confirm also the story of a secret meeting of First Contact happened during the strange absence of President Eisenhower in a February evening of 1954, while the President was on holiday in Palm Springs, in California, absence officially motivated with a sudden visit by a dentist for an emergency dental treatment. As a matter of fact on Saturday night of February 20, 1954, Eisenhower's Press Secretary announced that Eisenhower had lost a tooth cap while eating fried chicken and had to be rushed to a local dentist (source: Michael Salla, PhD, http://www.exopolitics.org/Study-Paper-8.htm). Here is a passage from Barbato's press release: "[…] the meeting with an Alien delegation at Muroc Air Field Base in February 1954 in the presence of president Dwight Eisenhower and James Francis McIntyre, bishop of Los Angeles. After that incredible event McIntyre flew to Rome to refer everything to Pope Pius XII who decided to found the S.I.V with the aim to gather every possible bit of information about Aliens and how they interacted with the American Government. From then bishop McIntyre and Detroit Archbishop Edward Mooney became the main information co-coordinators between the USA and the Vatican State. Incredibly, later on there should have been some direct personal meetings between S.I.V. members and a Nordic-looking race of Aliens coming from the Pleiades. These Aliens presumably warned humans against another alien race met by the Americans in the California Desert . These meetings between S.I.V and Aliens took place mainly in the USA territory but also - twice - in the Vatican State , precisely in Vatican Gardens at the Papal Academy of Sciences in presence of Pope Pius XII. My Jesuit contact also confirmed to me the reality of the George Adamsky-John XXIII meeting and talked about some very interesting details about it. He also called "Secretum Omega" the highest secrecy level in S.I.V, equivalent to the NATO Cosmic Top Secret."

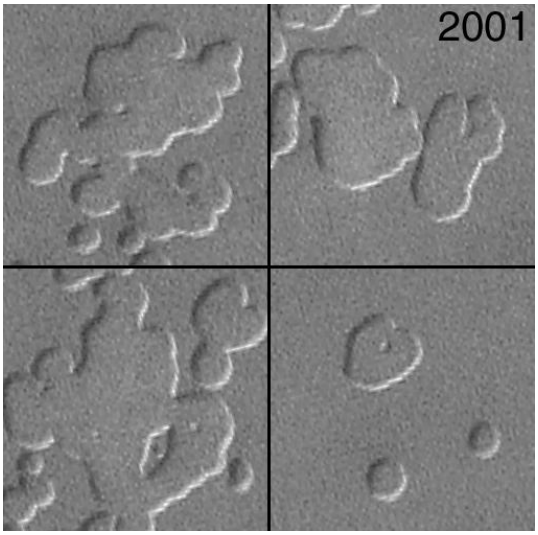
I interviewed Barbato for the Italian bimonthly magazine UFO Notiziario (UFO news), nr.62, April-May 2006, in which the magazine published some frames of the video and a very interesting presumed image (provided almost for sure by the Jesuit to Barbato), regarding the phantom "Aurora" (so far denied by U.S. officials) an American large secret hypersonic aircraft capable of a Mach 6 performance. In the presumed picture, taken by a classified STS mission in 2002, you can see a full-body shape aircraft (a black triangle) coming out from the earthly atmosphere to go into the Space. Other detailed information have been revealed on Barbato's website (www.secretum-omega.com), where last September the Italian freelance published on-line the interview to his contact, the Jesuit, taken place in 2001 in Rome. The Jesuit member of the S.I.V. told Barbato that on occasion of the secret meeting at Muroc Air Field Base, in 1954, military cameramen filmed the outstanding event "with three movie cameras (16 millimeters), detached in different places, loaded with colour film and working by spring engines; this last rather unconformable resolution, because it compelled every cameraman to change reel every 3 minutes, it was necessary since in the presence of the Aliens and of their spacecrafts, the electrical engines of the biggest movie cameras did not work. They filmed 7 rollers of 30 meters, a total of 20 minutes shot." Among the Jesuit's revelations, two of them are astonishing: about the planetoid visible in the videotape, the Vatican insider told the Italian freelance that it is the Planet X (the Sumerian Nibiru); about the "Guardian Files", he confessed him are a "dramatic truth", apart from the frames of the presumed E.B.E.

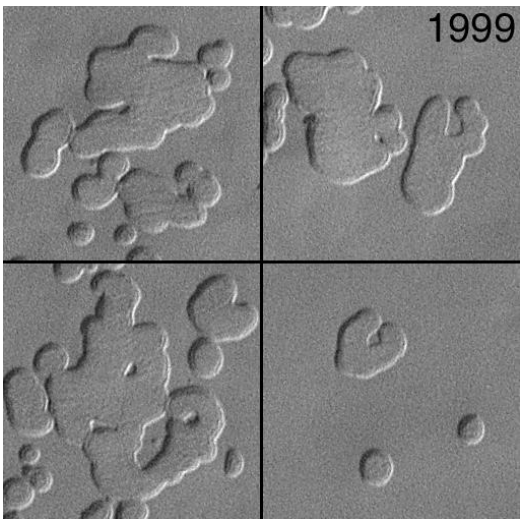
The Barbato' s researches shocked me and roused me to investigate as journalist the "Secretum Omega" enigma. Since 2005 up to now, on some magazines, websites and essays, I found out several circumstantial evidences that seem to prove the existence of the S.I.V. and the "Secretum Omega", their highest clearance. Barbato, before than me, found the most important and explicit of them on an historical essay, a book written by Mark Aarons and John Loftus, entitled "Ratlines" (see chapter 1). Anyway, above all because of the mass-media silence, I decided to baptize the Barbato's video with the name of "Jesuit Footage", to draw upon it the public attention. And finally I found an indirect remarkable confirmation of Barbato's testimony: Dr. Steven M. Greer (M.D.), in his recent book "Hidden Truth - Forbidden Knowledge", revealed in the chapter nr. 16 (passages of it have been published by Nexus New Times

magazine, on the survey "Twilight Zone", nr 64, October-November 2006) that, during a meeting with some rebel insiders taken place in December 1994 in Phoenix by Wrigley Mansion, one of them confessed him that determinate Jesuits control technology on UFOs information and contacts with Aliens. So I am convinced that the disturbing inquiries carried out by Barbato deserve our maxim attention, especially to understand how much truth there is about the next Planet X's arrival.

GLOBAL WARMING ON PLUTO,
ON TRITON
(+ 7° since 1989)

AND ON MARS...





WHAT IS GOING ON IN THE SOLAR SYSTEM AND IS THE "PLANET X" APPROACHING?

THE "JESUIT FOOTAGE" AND THE "SECRETUM OMEGA"

by Luca Scantamburlo

In the last years an Italian freelance, by the name of Cristoforo Barbato (Naples, 1972), received from an eyewitness many reliable information about the Planet X return and the activity of a presumed intelligence agency composed by Jesuit priests (whose code name would be S.I.V., "Servizio Informazioni del Vaticano" which in Italian means "Vatican Intelligence Service"). Barbato's contact is a man who introduced himself as a Vatican insider working by the Holy See as Jesuit.

At the beginning (year 2000) Barbato was very skeptical and suspicious on that self-styled insider, but at a certain point of his contacts (lasted at least for a couple of years) he was able to check his credentials: the man was really a Father belonging to the Jesuitical Order and operative in the Vatican City. Of course Cristoforo Barbato has been protecting the identity of his source of information as required by the ethical-professional code of the journalism.

The Italian freelance also demanded a meeting with him, as a necessary condition to carry on the contacts. In spite of the danger the Vatican insider accepted, and I suppose he was aware it was necessary considering his baffling revelations. So two meetings took place in a public space in Rome in 2001. What Barbato learnt from him was that inside the S.I.V. there was a group in a minority which disagreed with the policy adopted towards the Planet X problem. So, in my opinion, the revelation of the "Jesuit Footage" was as the matter of fact the result not just of a simple betrayal of a bond of secrecy, but a breach likewise the Antigone's morals, but with a much higher risk: the survival of our civilization.Moreover, as proof, in the same year the Vatican insider sent to Barbato a videotape by post, videotape that I have baptized "Jesuit Footage" to draw upon it the public attention: an editing of about 2 minutes regarding observations in the deep space of a planetoid with a thick atmosphere (the presumed Planet X), while it was approaching to the Solar System but still beyond the Neptune's orbit.

The video - I had the opportunity to watch it many times - shows an introduction of writings of classification on it (one of them is "Secretum Omega", the highest security clearance in the S.I.V, equivalent to to the NATO CTS, "Cosmic Top Secret") and would have been carried out by a secret space probe named "Siloe". The Vatican deep throat told Barbato that the space probe, ordered by secrecy to the Lockheed Martin and equipped

with a sophisticated infrared camera and an electromagnetic impulses propulsion, was assembled in Area 51 (Nevada) and then orbited by an Aurora-type secret hypersonic aircraft in the 1990s; the space probe Siloe, always according to the Barbato's contact, sent the images of the planetoid in October 1995 (after it came back to the border of Solar System to have enough power for an efficacious signal) to a secret radio telescope hidden in an unused oil-refining plant in Alaska, totally managed by some Jesuits belonging to the S.I.V. The radio telescope, he added, was built in 1990 to observe anomalous celestial bodies on approaching the Solar System. About the planetoid visible in the videotape, the Vatican insider told the Italian freelance that it is the Planet X (the Sumerian Nibiru).

But only some years later – precisely on 30 April 2005 - Barbato decided to reveal the outstanding story and to show the "Jesuit Footage" to the public: it occurred at the " Province Palace " of Pescara (Italian city on the Adriatic Coast) by the Conference "UFO? the Truth is Top Secret, from Area 51 to Planet X", organized by the "Ufobserver", Italian cultural association in Pescara . In fact from 2001 to 2005 Barbato worked (and he still has been working) to find any circumstantial evidences that could prove the existence of "Nibiru" (the Planet X)[1][1] and of the S.I.V. (Vatican Secret service). About the S.I.V. he found the most important and explicit of them on an historical essay, a book written by Mark Aarons and John Loftus: *Ratlines* (see chapter 1). I have found another indirect reference on an Italian essay written by Lt. Col. Umberto Rapetto and by the journalist Roberto Di Nunzio: *L'atlante delle spie*, BUR Publisher, Milan, 2002), chapter 5 (Lo spionaggio in porpora: il Vaticano), on page 89 of the paragraph 2.3 (Le nunziature) when they talk about Robert A. Graham, a Jesuit: in the past he made an implicit remark on the existence of the Vatican Secret Service.

Discredit or slow release of classified information? Barbato, according to his witness, was instructed to spread - by the media – news of vital importance to help mankind to face some events which, in the future, will involve all the creatures of the Earth. For more details about his testimony and researches, the reader may have a look at the interview to the Italian Jesuit (by Cristoforo Barbato, all right reserved) taken place in Rome in 2001, translated into English and published on a well-known Canadian website:

www.ufodigest.com/news/1206 /omegasecret.html

INDIRECT CONFIRMATIONS: STRANGE ANOMALIES IN THE SOLAR SYSTEM

Is there any strong indirect confirmation of the "Jesuit Footage" classified "Secretum Omega"? The answer is yes: the American doctor Steven M. Greer (responsible and founder of the Center for the Study of Extraterrestrial Intelligence (CSETI) and of the Disclosure Project (http://www.disclosureproject.org) has recently published a book of

memories: *Hidden Truth – Forbidden Knowledge*. At the chapter 16, intitled *Circles of Power – Behind UFO Secrecy*, we can read:

But among all the things the Jesuit (member of the SIV) told Barbato in 2001, two are really disquieting from my point of view. We can begin to look into the first one: at the latest beginning from 2004 the Planet X (the Sumerian "Nibiru") would have begun to affect the Solar System with his presence (see my interview with Cristoforo Barbato on pag.40, *UFO Notiziario*, Italian bimonthly magazine, number 62, April-May 2006).

Is there any evidence of it? The answer could be yes because the evidences seem to be several, not just one. Let us see what they could b e.

First of all the anomalous Sun activity: if you have patience you can see the data recorded by the Nobeyama Radioheliograph (NoRH), a Japanese radio telescope which works as a radio interferometer dedicated to observe the Sun. As Khoji Lang pointed out, "the Sun definitely is strongly connected with what's going on down here on Earth" (Shooting Star, March 21, 2003 - monthly cosmological newsletter by Khoji Lang

www.detailshere.com/solaractivity.htm.

There is also a chart by the Nobeyama website where you can see the incredible trend of the solar flares in the last years: here you are the link:

solar.nro.nao.ac.jp/norh/html/n_flares.html.

It is a scientific research and there is not much to say about it: it is an evidence that we must take it in consideration. About the technical details of the Nobeyama Radioheliograph, here you are the link: http://solar.nro.nao.ac.jp/norh/html/introduction.html; If somebody have some doubts, I invite her/him to read the following report about the green house effect and the global warming: <<*The truth about global warming - it's the Sun that's to blame*>>, by Michael Leidig and Roya Nikkhah:

<<Global warming has finally been explained: the Earth is getting hotter because the Sun is burning more brightly than at any time during the past 1,000 years, according to new research. A study by Swiss and German scientists suggests that increasing radiation from the sun is responsible for recent global climate changes […] Dr Solanki said that the brighter Sun and higher levels of "greenhouse gases", such as carbon dioxide, both contributed to the change in the Earth's temperature but it was impossible to say which had the greater impact.>>

By Michael Leidig and Roya Nikkhah

(Filed: 18/07/2004)

www.telegraph.co.uk/news/main.jhtml?xml=/news/2004/07/18/wsun18.xml&sSheet=/news/2004/07/18/ixnewstop.html

Moreover lately some planets of the Solar System have been showing anomalous behaviours. I am talking about the following:

1) the Global Warming on Pluto Puzzles Scientists (see Special Reports, SUV's On Jupiter? - Solar System Warming, Are humans responsible for climate change on the outer reaches of the solar system, or is it the sun? (2006 11 17- Space.com):

<<[…] In what is largely a reversal of an August announcement, astronomers today said Pluto is undergoing global warming in its thin atmosphere even as it moves farther from the Sun on its long, odd-shaped orbit.>>

www.redicecreations.com/specialreports/2006/11nov/solarsystemwarming.html

2) the Global Warming Detected on Triton, one of the Neptune's satellites, 28 June 1998 :

[…] At least since 1989, Triton has been undergoing a period of global warming," confirms astronomer James Elliot, professor of Earth, Atmospheric and Planetary Sciences at Massachusetts Institute of Technology. "Percentage-wise, it's a very large increase."

www.scienceagogo.com/news/19980526052143data_trunc_sys.shtml

3) the Global Warming on Mars reported in the NASA JPL article "MOC Observes Changes in the South Polar Cap: Evidence for Recent Climate Change on Mars", MGS MOC Release No. MOC2-297, 6 December 2001:

[…] New MGS Mars Orbiter Camera (MOC) images have provided a startling observation: The residual martian south polar cap is changing. The fact that it is changing suggests that Mars may have major, global climate changes that are occurring on the same time scales as Earth's most recent climate shifts, including the last Ice Age. MOC images of the south polar cap taken in 1999 were compared with images of the same locations taken in 2001, and it was discovered that pits had enlarged, mesas had shrunk, and small buttes had vanished.

mars.jpl.nasa.gov/mgs/msss/camera/images/CO2_Science_rel/index.html

4) the New Storm on Jupiter Hints at Climate Change, by Sara Goudarzi, Staff Writer,

posted: 04 May 2006 , 01:00 pm ET

A storm is brewing half a billion miles away and in a rare event, astronomers get to watch it closely. Jupiter is growing a new red spot and the Hubble Space Telescope is photographing the scene. Backyard astronomers have been following the action, too. "Red Spot Jr." as it is being called, formed after three white oval-shaped storms—two of which were at least 90 years old—merged between 1998 and 2000.

www.space.com/scienceastronomy/060504_red_jr.html

5) the huge hurrican on Saturn, visible in the images acquired on October 11, 2006, by the Cassini spacecraft (NASA-ESA-ASI); the news was reported in the weeks of Autumn by the media, included the BBC:

A hurricane-like storm, two-thirds the diameter of Earth, is raging at Saturn's south pole, new images from Nasa's Cassini space probe reveal. Measuring 5,000 miles (8,000km) across, the storm is the first hurricane ever detected on a planet other than Earth. Scientists say the storm has the eye and eye-wall clouds characteristic of a hurricane and its winds are swirling clockwise at 350mph (550km/h) […] <<*We've never seen anything like this before. It's a spectacular-looking storm*>> - Michael Flasar, Nasa astrophysicist

news.bbc.co.uk/1/hi/sci/tech/6135450.stm

6) the Unexpected Meteor Shower Reals Presence of Potentially Dangerous Comet by Peter Jenniskens,

<<SETI Institute scientist and meteor expert Peter Jenniskens reports in a telegram issued by the International Astronomical Union's Minor Planet Center that an unexpected burst of meteors on October 5, 2005 has occurred, which betrayed the presence of a thusfar unknown, potentially Earth-threatening, comet. […] The comet itself has not yet been discovered and is likely to return to Earth's vicinity only once every 200 - 10,000 years.>>

www.seti.org/site/pp.asp?c=ktJ2J9MMIsE&b=1233789

For more information about it you can check the *OUTBURST OF OCTOBER CAMELOPARDALIDS*, by Peter Jenniskens, Jarmo Moilanen, Esko Lyytinen, Ilkka Yrjölä, Jeff Brower (2005 October 5). The news was reported in WGN, the Journal of the *International Meteor Organization*.

FIRST INDIRECT CONFIRMATIONS OF THE "GUARDIAN FILE"

Another thing very disquieting that the Italian Jesuit told Barbato in 2001 is about the so-called "Guardian File", known also as "The Carp Case": he confessed him it is a "dramatic truth", apart from the shot of a presumed E.B.E. which could be a fake and the date scheduled for an attack to the West by the some alien forces with their Chinese and Arab allies, only postponed: it was expected

<<[…] within the next 5 years. Waiting longer than that would make it impossible even for the aliens to reverse the ecological damage inflicted on the Earth by Man.>>"

- quotation from the Guardian Documents.

If the Guardian File is true or partially true, September 11 Attacks could be only a deferred step of that strategy, or a criminal attempt carried out by some black groups operative in the USA: in this last case they got the casus belli (the war opportunity) to prepare a strategic drive, so as to have an advantage in terms of plans of operations.

Is there any confirmation of that? And what "the Guardian File" is? It is a package of documents sent to some Canadian and American UFO researchers by an anonymous individual calling himself "Guardian" (1989-1991). In 1991 Guardian sent also a videotape which shows a presumed UFO on the ground: the UFO would be the alien spacecraft mentioned in the documents, always according to the mysterious sender, landed on Nov 4th 1989 in a deep swamp near Corkery Road, Carp, in Eastern Ontario (Canada). The alien ship, Guardian tells, was captured by special forces specialized in crash retrieval after that Canadian and American Security Agencies were immediately notified by the spy satellites which had traced the movements of it in the area. We can read from the Guardian papers:

<<[…] Two AH-64 Apaches and a UH-60 Blackhawk headed for the area the following night.The helicopters carried full weapon loads. They were part of a covert American unit that specialized in the recovery of alien craft. Flying low over Ontario pine trees the Apache attack choppers soon spotted a glowing, blue, 20 metre in diameter sphere. […] Through the night a special team of technicians had shut-down and disassembled the sphere. Early the next morning Nov. 6, 1989, construction equipment and trucks were brought into the swamp. The UFO parts were transported to a secret facility in Kanata, Ontario […] In the cargo hold were found ordinance racks containing fifty Soviet nuclear warheads. Their purpose was revealed by advanced tactical/combat computers located in the flight deck.>>

The reader interested in the Carp-Guardian Case may check one of the best works of documentation on it, by Joe Daniels:

ufo-joe.tripod.com/cases/1989carp.html#guard

About the 3 crew members who were found inside the alien spacecraft, they were not human being:

<< [...] The reptilian, foetungs, were listed as CLASS 1 NTE's. (Non Terrestrial Entities). Like others recovered in previous operations, they were muscular, grey-white skinned,

humanoids.>>

The presumed "conspiracy" orchestrated by China together with some alien (reptilian?) and Arab forces who would plane to take over the world, of course it does not mean that the Chinese and Arabs, and their Goverments, are evil: as a matter of fact, for example, the German people that during the Second World War followed the Nazi policy, were human beings like us, just not enough aware of the dangers carried by the totalitarian ideologies. In the ex Soviet Union happened something very similar to that. But let us read another important passage from the Guardian documents:

<<Threatened by recent East-West relations, and the revolutionary movements within itself, Red China is preparing for the final ideological war. The aliens have agreed to defend China from the free world's combined military and nuclear forces. At this time China is arming the Middle East with their own nuclear arsenals, in order that they can successfully take on Israel. Unifying the Arabs under one Chinese command was simple, especially with Israel's recent "iron fist" attitude toward occupied territories.

The Soviet warheads found in the UFO were destined for Syria. CIA operatives in the Middle East have noticed huge movements of Chinese "technicians" and "advisors". China is also supplying the Arabs with bacteriological agents, Migs, Hind gunships, tanks, and missile launchers.>>

Do you think that this story looks like a science-fiction movie? Before 9/11 it could be but now it should be at least to raise a doubt.

Above all because last September the *Daily Telegraph* (UK) published an astonishing news which could be an indirect confirmation of the Jesuit's testimony and of the Carp-Guardian Case:

<<China has secretly fired powerful laser weapons designed to disable American spy satellites by "blinding" their sensitive surveillance devices, it was reported yesterday. The hitherto unreported attacks have been kept secret by the Bush administration for fear that it would damage attempts to co-opt China in diplomatic offensives against North Korea and Iran. […] American satellites like the giant Keyhole craft have come under attack "several times" in recent years. Although the Chinese tests do not aim to destroy American satellites, the laser attacks could make them useless over Chinese territory.>>

By Francis Harris in Washington, *Daily Telegraph,* 26 September 2006, UK

www.telegraph.co.uk/news/main.jhtml?xml=/news/2006/09/26/wchina226.xml

About the American Keyhole-type satellites I want to point out that the Italian Jesuit who contacted Cristoforo Barbato, provided him with a picture of a two commemorating brooches: one of them is dedicated to the "Hubble Space Telescope NASA"; the other one to the "Keyhole-12 Super Spy in space CIA NASA". The photo was published on page 28 of UFO Notiziario, nr.62, April-May 2006. Is the Keyhole-12 real? If somebody judges not credible the Daily Telegraph news, may read the already well-know information about the

American spy satellites, including the Advanced Keyhole / IMPROVED CRYSTAL / "KH-12":

<<The IMPROVED CRYSTAL can be imagined as a Hubble Space Telescope, with a large rocket engine attached to provide maneuverability. Like the Space Telescope, the IMPROVED CRYSTAL is about 4.5 meters (15 feet) in diameter, and with addition of its maneuvering module, is over 15 meters (50 feet) long (compared to the 13 meter Space Telescope). Contractors on the IMPROVED CRYSTAL include TRW and Lockheed.>>

www.globalsecurity.org/space/systems/kh-12.htm

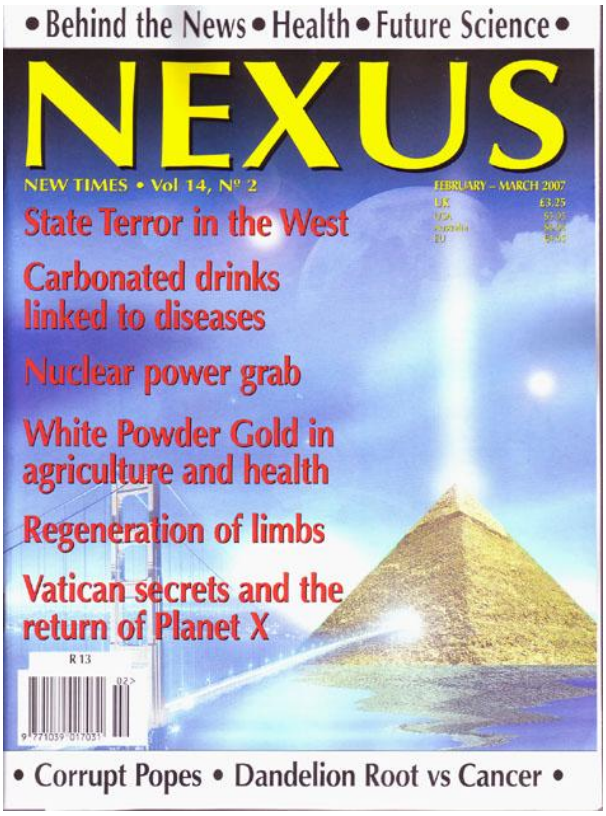
The anomalies of the Solar System I have mentioned above, the "Guardian File" and the disturbing inquiries carried out by the Italian freelance Cristoforo Barbato deserve our maxim attention. They should catalyze the public attention on the Planet X arrival and on the exopolitical problems: like the involvement of goverments in management of UFO subject and how so far the United States , or some secret groups of a Shadow Government (with no congressional, presidential and NSC oversight) have managed extraterrestrial affairs.

In my opinion the only chance we have to know what really is going on the Earth and in the Solar System, is to help researchers like dr. Steven M. Greer (www.disclosureproject.org), prof. Michael Salla (www.exopolitics.org), Richard M. Dolan (historian), Cristoforo Barbato (freelance, www.secretum-omega.com) and many others who understand how much important is to widen mankind horizons in every dimension, both physical and spiritual. In that case it will be more likely to avoid the fraticidal struggles and the horrors of nuclear warfare that seem to be at the gates.

December 19, 2006

[1] A massive planet, still unknown to the modern astronomy, produces the perturbations which Lowell found for Uranus and those Pickering found for Neptune. We can tell it with mathematical certainty since 1978, when the astronomer James Christie (US Naval Observatory) discovered the satellite Charon and in consequence determined the mass of the Pluto-Charon system. So a huge planet remains to be found.

By a written permission of the author, an adaptation of the report above, was published on the bi-monthly magazine *NEXUS NEW TIMES* - nr. 2, Vol.14, February/March 2007 - with the following title:
The Jesuit Footage and "The Omega Secret" Code - pagg. 63-65;



Vatican Observatory Statement on MGIO and Ecology

STATEMENT OF THE VATICAN OBSERVATORY ON THE MT. GRAHAM INTERNATIONAL OBSERVATORY (MGIO), THE ECOLOGY OF THE PINALEÑO MOUNTAINS, AND RELATED POLITICAL ISSUES

The Vatican Observatory (*Specola Vaticana*) has constructed the Vatican Advanced Technology Telescope (VATT) on Mt. Graham in Graham County, Arizona, USA, as part of the Mt. Graham International Observatory (MGIO). A campaign of protest continues to be conducted by some persons and institutions who claim that the MGIO is a threat to the ecology of the area and/or that environmental laws of the United States have been violated. The following is the current position of the Vatican Observatory. (A separate statement has been prepared by the Vatican Observatory on: *The Mount Graham International Observatory and American Indian Peoples*.)

Description of the Natural Environment
The Pinaleño Mountains lie within the Coronado National Forest which comprises 201,300 acres. The mountain range contains some of the highest elevations in Arizona and the highest south of the Mogollon rim. There are four peaks which exceed 10,400 feet, the highest being Mt. Graham (also known as High Peak) at 10,720 feet. The name Mt. Graham is also used in general

to refer to this whole range. It is in that sense, unless otherwise clearly specified, that we use it in this Statement. It is a precious, isolated, ecological zone, containing flora and fauna typical of both the northern Rocky Mountains and the Sierra Madre. Unique plants and animals, which have evolved since the last glaciation of about 11,000 years ago are encountered here. These include the largest and healthiest bear population in the State and other rare animals such as the Mt. Graham red squirrel. The ecology of Mt. Graham is extraordinary, since it combines life zones typical of northern Mexico with those of southern Alaska.

There has, however, been much change to Mt. Graham in the last century. Perhaps the greatest change to the natural environment of Mt. Graham was the construction of a 30 mile long highway in the 1930's. This highway has provided and continues to provide public access to all peoples without discrimination for the many activities that are permitted on Mt. Graham. In the past these have included lumbering, hunting, communication antennas, recreational areas, etc. In addition to the road, a number of campgrounds, and a bible camp, there are two villages of summer cottages with 94 cottages in all, some of them already historic monuments. Two artificial lakes have been created. On one summit there is a communications site with antennas and high towers. US Forest Service records show that about one-quarter of the available timber on the mountain's higher elevations has been logged, totaling about 68,000,000 board feet or 6,000 acres of timber.

Despite these drastic changes to the natural environment of Mt. Graham, there exists at its highest elevations a precious micro-ecosystem which contains unique plants and animals. According to the US Forest Service there are approximately 4,000 acres of spruce fir forest, of which about 3,300 acres are either mature forest or old growth. The red squirrel, which was placed on the Endangered Species list in 1987, lives on Mt. Graham. For the most part the squirrels live at elevations of about 9,000 feet, below the spruce fir; but a large concentration has also been found at an elevation just above 8,000 feet. In fact, the biological evidence to date suggests that the greatest variability of habitat quality for the squirrel occurs at the highest elevations in the spruce fir, and that the reservoir that permits the squirrel to remain on the mountain in difficult times is the lower mixed-conifer forest. It is estimated that there are more than 11,000 acres of squirrel habitat on the mountain.

Description of MGIO

Two telescopes have been constructed on Emerald Peak at an elevation of 10,471 feet (the fourth highest peak) and the construction of a third telescope is about to begin. These are located on 8.6 acres surrounded by the 62,000 acre area designated by Congress as the *Mt. Graham Wilderness Study Area*, a part of the 200,000 acre Coronado National Forest. The telescopes already constructed are: the Vatican Advanced Technology Telescope (VATT, a joint enterprise of the Vatican Observatory and the University of Arizona), the Sub-millimeter-Wave Telescope (SMT, a joint enterprise of the Max Planck Institute of Bonn, Germany and the University of Arizona). Construction is about to begin on the Large Binocular Telescope (currently a joint enterprise of the Italian National Astronomy Program, the University of Arizona and the Research Corporation of Arizona). An evaluation of the environmental impact of these first three

telescopes is being continuously conducted. If the evaluation is favorable, four more telescopes may be built and this will extend the total area of the MGIO to a maximum extent of 24 acres, confined within a 150 acre area set aside for scientific studies.

Administration of the Area

The area is under the administration of the Coronado National Forest of the US Forest Service (USFS). Since the 1970's, the USFS has handled all issues concerning Mt. Graham in accordance with the National Environmental Policy Act (NEPA), by carrying out investigations of areas suspected to contain archaeological material, or those of biological interest etc., with public hearings and opportunities for public comment, which are all documented in substantial, publicly available reports.

Starting in 1980, the area was investigated for the likelihood of it being a site of major importance for astronomical telescopes. In 1981 there was discussion of the observatory with civic leaders from the communities at the foot of the mountain and with congressional representatives. The possibility of an observatory was discussed in the press, both in the Gila Valley where Mt. Graham is located and in Tucson where the Vatican Observatory Research Institute (VORG) has its headquarters.

These factors, namely, that the area, although it had served many uses over the years, was still both ecologically precious and a possible prime site for astronomy, led the Committee on Interior and Insular Affairs of the US House of Representatives to designate this area in 1984 as the *Mount Graham Wilderness Study Area* so that its management might be "directed toward protection of its extraordinary wildlife and plant life and towards maintaining this area in a more pristine condition than what is normally found in national forest recreation areas. . . . It is the Committee's intent that the area be managed so as to protect its wilderness qualities and **also to allow all reasonable scientific activities necessary to ensure that planning and study on proposed observatory sites and associated facilities continue unimpeded**" (Sec. 102 of H.R. 4707, emphasized text by me).

In 1985, as part of a plan for the development of the entire Coronado National Forest, a plan for an observatory was unveiled in a draft Environmental Impact Statement (EIS) by the USFS. This was followed by public hearings. Due to intense public interest and letter writing about the MGIO the USFS announced in the Final Impact Statement for the Coronado National Forest Plan, issued in 1986, that there would be a separate EIS for the observatory. The draft EIS on the Observatory was issued in late 1986 and this was followed by public hearings concerning the environment. The Mt. Graham red squirrel was listed as an endangered species which began a new process of verifying that the conditions of the Endangered Species Act (ESA) were fulfilled. This process resulted in additional public hearings and comments. In 1988 the US Fish and Wildlife Service (USFWS), the federal agency responsible for the implementation of the ESA, issued a Biological Opinion containing a "Reasonable and Prudent Alternative Three" which allowed the MGIO to be built on Emerald Peak. After this the US Congress passed the Arizona-Idaho Conservation Act (AICA), and the USFS issued its final EIS for MGIO.

Title VI of the AICA came about in the following way. In 1988 representatives of MGIO, the USFS, and the USFWS agreed on all terms and conditions for building MGIO according to the

USFWS Biological Opinion (specifically according to "Reasonable and Prudent Alternative Three" of that Opinion). The US Congressional Delegation from Arizona, which had asked to be kept informed of negotiations with federal agencies concerning MGIO, was advised that, although an agreement had been reached, there was likely to be a further delay of some years for administrative efforts to prepare for all possible judicial proceedings which MGIO opponents were likely to initiate. The Delegation, judging that such delays in a process which had already been underway since 1984 would jeopardize the project, then incorporated the agreement already reached into the AICA, which Congress passed and President Reagan signed into law in late 1988.

According to the dictates of Title VI of the AICA the USFS issued a special use permit in 1989 for the construction of the first three telescopes, an access road, and support buildings for the MGIO. Construction began on the access road and the first two telescopes, including the VATT. Opponents to the MGIO filed suits in federal courts. After various temporary injunctions issued by the District and Ninth Circuit Courts were all finally dismissed, construction continued on the basis of the Ninth Circuit Court decision which dismissed all charges of the opponents and passed the judgement that no further consultation was necessary for the construction of the first three telescopes of the MGIO, including the access road and support facilities. A group called "The Apache Survival Coalition" filed a suit against the USFS on 19 August 1991 in the US District Court in Phoenix, Arizona to stop the MGIO claiming that Mt. Graham was sacred and they also filed in the same court on 10 February 1992 a Motion for a Partial Summary Judgement in which they request the court to decide that Title VI of the AICA is unconstitutional. Both the suit and the Motion were defeated in the courts. On 10 April 1992 the US District Court in Phoenix, Arizona denied a request of the Apache Survival Coalition for a temporary restraining order and a preliminary injunction against construction of the MGIO. An appeal to the Ninth Circuit Court was denied on 21 April. Subsequently, the first two telescopes were constructed on Mt. Graham. These are the Vatican Advanced Technology Telescope and the Sub-Millimeter Wave Telescope of the Max Planck Institute for Radio Astronomy. Ground was cleared in late 1993 for the third telescope, the Large Binocular Telescope (LBT). Upon request by the U.S. Forest Service the original site for the LBT was moved to a site which was less sensitive ecologically. The Mount Graham Coalition requested an injunction against further clearing at this new site and the injunction was granted by the District and upheld by the Ninth Circuit Court. The Tribal Council of the San Carlos Apaches has not become a party to these court cases. In April 1996 legislation was passed in the U.S. Congress to reaffirm the wishes of Congress expressed in the Arizona-Idaho Act that the first three telescopes, including the LBT, be constructed without further delay. This is allowing the completion of the first phase of the MGIO, the operation of the first three telescopes on Mt. Graham.

Position of the Vatican Observatory

The Vatican Observatory has made its decision to participate in the MGIO based upon a thorough and independent examination of the facts concerning the ecology of Mt. Graham and the political and legal issues involved in the granting of a permit for the MGIO by the USFS. These have been summarized in the previous paragraphs.

Mt. Graham is the best site in the continental US for the construction of MGIO and specifically for the construction of the VATT. Other sites are either inferior from astronomical and/or

logistical considerations or they are more sensitive ecologically. This judgement is based upon the examination of data for 280 sites in the continental United States.

The MGIO is perfectly compatible with the other legitimate uses of the mountain and with all ecological considerations that have come to light. A protective program of biological investigation and surveillance was begun in 1989 as part of the conditions by which the permit was granted for the MGIO. This will assure that all ecological considerations will be met. This assurance has been verified during all phases of the construction and operation of the telescopes. Among those conditions are requirements for reforestation and for monitoring of the red squirrel population. Through the fulfillment of those conditions, to which the MGIO is committed, it is already clear that the natural environment is better off than it would have been without the MGIO. Many more acres of forest are being restored than the MGIO will occupy. These reforestation efforts will not bear fruit immediately but they have begun and 60 acres have already been restored through the efforts of MGIO and the USFS. On the construction site itself 800 conifers have been transplanted into the adjoining forest with a survival rate greater than 96 per cent. The official census by the USFS of the red squirrel shows that the population has more than doubled between 1989 and the present. Construction of the observatory began in 1989. The search for squirrel middens in the lowest parts of the mixed-conifer forest is far from complete. However, the distribution of middens known to date, together with the historical record of squirrel sightings, suggests that a primary habitat of the red squirrel (to distinguish it from the critical habitat designated by the USFWS in accordance with ESA) is not at or even near to the observatory site; it is at least 1,000 feet below it. Furthermore, scientific studies of significant biological interest in this isolated example of mixed conifer forest will be promoted by the MGIO and by the conditions required by federal law for its existence. These newly protected parts of the Pinaleño Mountains will provide a magnificent natural laboratory for the study of a recovering ecological system.

The congressional legislation which has enabled the construction of the first three telescopes of the MGIO is sound and in perfect keeping with all the tenets of the democratic process and of participatory government in the United States. The AICA did not violate previous legislation. With respect to the construction of the first three telescopes, including access road and support facilities, it deemed that what had been intended by previous legislation had been fulfilled and it granted legislative relief from further bureaucratic delays, which it deemed contrary to the intent of existing legislation. Specifically the AICA states that " . . . the requirements of section 7 of the Endangered Species Act shall be deemed satisfied as to the issuance of a Special Use Authorization for the first three telescopes . . . [AICA, Title VI Sec. 602 (a)]". A similar statement is made by AICA (see Sec. 607) with respect to the requirements of NEPA. The Vatican Observatory respects and supports the National Historic Protection Act, the National Forest Management Act, the National Environmental Policy Act (NEPA), the Endangered Species Act (ESA), the Arizona Wilderness Bill, which established the *Mt. Graham Wilderness Study Area*, and the Arizona-Idaho Conservation Act (AICA), which provided for the granting of a permit by the USFS for the construction of the MGIO. To date no challenge stating that those laws have not been obeyed in the case of the MGIO has been upheld by the Federal Courts.

The participation of the Vatican Observatory in the MGIO is completely consonant with all public statements of Pope John Paul II concerning the environment. The Vatican Observatory is

profoundly committed to improving and preserving the natural environment of Mt. Graham. Contrary to misinformation, which has been generated irresponsibly by some groups that oppose the MGIO and which has appeared in the press and in numerous letters directed to various Vatican offices, we find no conflict whatsoever between the construction of the Vatican Advanced Technology Telescope and those commitments. This conviction is based not only upon the public statements made by the Holy Father but also upon the principles which govern the United States of America according to which the use of Federal land is determined by specific or general rules set up by the representative government of the United States. We are inspired by the following words of Pope John Paul II:

This new telescope (he refers to the VATT) *under construction on Mt. Graham will be the first in a series of instruments which will enable scientists to see ten times further into the universe than ever before. In order to function as efficiently as possible, these telescopes must be located on remote mountain sites, many of which are treasured ecological zones. I know that, as scientists, you cherish and respect nature. Hence, while striving to fathom the ultimate frontiers of the Universe, you have sought to interfere as little as possible in the natural processes of the earth, that small but precious part of the Universe from which you observe.* (Address of John Paul II to the Founders of the Vatican Observatory Foundation, 19 June 1989)

It appears that some environmental organizations are trying at whatever cost and by whatever means to stop the construction of telescopes on Mt. Graham. It is difficult to interpret their motives, since they give no semblance of being based upon an honest desire for true conservation of the environment. On the contrary their agenda appears to be completely negative. They are against telescopes, against scientific research, against progress. Their emphasis is not upon preserving but rather upon preventing. Their kind of environmentalism is inevitably doomed to failure. This has been shown by the acts of the United States Congress and by the Federal Courts.

The issues concerning the MGIO will undoubtedly continue to generate much controversy arising from many honest, divergent views concerning the need to preserve the environment and the insatiable curiosity to know where it and human civilization itself came from. We are always open to discussing those honest, divergent views. It is our current conviction that in due time MGIO will contribute both to the conservation of the environment and to the knowledge of its ultimate origins. The Vatican Observatory is totally committed to the MGIO and is proud to have completed the first optical telescope on Mt. Graham and to have obtained in January 1995 the first high-resolution images of selected celestial objects which establish beyond doubt the high quality of Mt. Graham for optical and infrared astronomy.

George V. Coyne, S.J.
Director
Vatican Observatory
Tucson, Arizona
Last revised 8 May 1997

Vatican Tied Mount Graham Observatory Launches LUCIFER Telescope.
Why the Vatican call the new telescope "LUCIFER"? 
Why the Vatican is so interested on what happen in the sky?

They search LUCIFER (bearer of the light) in the sky? Isn't Lucifer the fallen Angel?
Or is something else?

Maybe LUCIFER is an acronym for:

Large Binocular Telescope Near-infrared
Utility with
Camera and
Integral
Field Unit for
Extragalactic
Research

Although no 'official' confirmation of Nibiru's existence has been announced–as of January of 2005, NASA does claim to be tracking a newly discovered 'dwarf-planet' beyond Pluto that has been named 'Eris' after the Greek Goddess of 'strife'. Her companion moon is named 'Dysnomia'–also Greek for 'lawless'. It should be noted, however, that Eris gives off a suspicious red glow quite like that attributed to Nibiru. Also, vast sums of money are being spent by American, European and Japanese space agencies to launch a fleet of solar observatories to monitor the increase of solar flares coming from our sun.

Curiously, the orbiting Hubble Telescope which was originally scheduled for shut-down in 2007 was retro-fitted to keep functioning until 2013. And in August of 2008 the Hubble telescope was scheduled to be refitted with additional 'classified' hardware, as well as special heat shields.
In 2003 the Spitzer Space Telescope was launched as the world's largest orbiting infrared telescope. And in addition we now have 'SOFIA'–NASA's Stratospheric Observatory For Infrared Astronomy–high altitude jumbo jets fitted with onboard telescopes for astronomical study.

The South Pole Telescope (SPT) is a 10 meter diameter telescope located at the Amundsen-Scott South Pole Station, Antarctica. It is a microwave/millimeter-wave telescope that observes in a frequency range between 70 and 300 GHz. The primary science goal for SPT is to conduct a survey to find several thousand clusters of galaxies, which should allow interesting constraints on the Dark Energy equation of state.

Science goals
The first key project for the SPT will be a >1000 square degree survey to search for clusters of galaxies using the Sunyaev-Zel'dovich effect, a distortion of the cosmic microwave background radiation (CMB) due to interactions between CMB photons and the hot, ionized gas in clusters. Given three years of observing the South Pole Telescope should find several thousand clusters of galaxies, which should allow interesting constraints on the Dark Energy equation of state.

PART 4 : COMING UP FOR AIR.....

Alpha Magnetic Spectrometer

From Wikipedia, the free encyclopedia
Jump to: navigation, search

AMS-02

AMS-02 patch

Alpha magnetic spectrometer

Organization	AMS Collaboration
Mission Type	Cosmic Ray
Host Satellite	International Space Station
Launch	16 May 2011 8:56:28 AM

	EDT[1][2][3] (13:56:28 UTC)
Launch vehicle	Space Shuttle *Endeavour*
Launch site	Kennedy Space Center Launch Pad 39A
Mission duration	10 years or more[2]
Mission elapsed time	1 year, 4 months and 2 days
Mass	14,809 lb (6,717 kg)
Max length	
Power consumption	2000–2500 watts
Webpage	AMS-02 homepage
Orbital elements (ISS)	
Inclination	51.6 degrees
Orbit	LEO
Min altitude	341 km (184 nmi)
Max altitude	353 km (191 nmi)
Period	~91 minutes

The **Alpha Magnetic Spectrometer**, also designated **AMS-02**, is a particle physics experiment module that is mounted on the International Space Station. It is designed to search for various types of unusual matter by measuring cosmic rays. Its experiments will help researchers study the formation of the Universe and search for evidence of dark matter as well as investigate antimatter. The principal investigator is Nobel laureate particle physicist Samuel Ting. After final testing at ESA's European Space Research and Technology Centre (ESTEC) facility in the Netherlands,[4] delivery to the Kennedy Space Center in Florida took place on 26 August 2010.[5] The launch of Space Shuttle *Endeavour* flight STS-134 carrying AMS-02 took place on 16 May 2011, and the spectrometer was installed on 19 May 2011.[6][7] In July 2012, it was reported that AMS-02 had recorded over 18 billion cosmic ray events since its installation.[8]

History

The alpha magnetic spectrometer was proposed in 1995 by MIT particle physicist Samuel Ting, not long after the cancellation of the Superconducting Super Collider. The proposal was accepted and Ting became the principal investigator.[9]

AMS-01

AMS-01 flew in space in June 1998 aboard the Space Shuttle *Discovery* on STS-91. It is visible near the rear of the payload bay.

A detail view of the AMS-01 module (center) mounted in the shuttle payload bay for the STS-91 mission.

An AMS prototype designated *AMS-01*, a simplified version of the detector, was built by the international consortium under Ting's direction and flown into space aboard the Space Shuttle *Discovery* on STS-91 in June 1998. By not detecting any antihelium the *AMS-01* established an upper limit of 1.1×10^{-6} for the antihelium to helium flux ratio[10] and proved that the detector concept worked in space. This shuttle mission was the last shuttle flight to the Mir Space Station. The photograph was taken from Mir.[11][*dead link*]

AMS-02

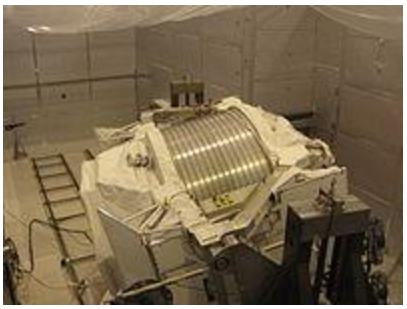
AMS-02 during integration and testing at CERN near Geneva.

After the flight of the prototype, Ting began the development of a full research system designated *AMS-02*. This development effort involved the work of 500 scientists from 56 institutions and 16 countries organized under United States Department of Energy (DOE) sponsorship.

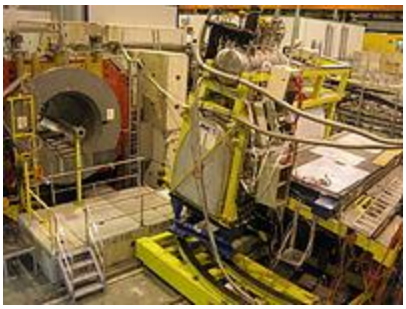
The instrument which eventually resulted from a long evolutionary process is "the most sophisticated particle detector ever sent into space", rivaling very large detectors used at major particle accelerators, and it has cost four times as much as any of its ground-based counterparts. Its goals have also evolved and been refined over time. As built it is a more comprehensive detector, which has (among other goals) a better chance of discovering evidence of dark matter.[12]

The power requirements for *AMS-02* were thought to be too great for a practical independent spacecraft. So *AMS-02* was designed to be installed as an external module on the International Space Station and use power from the ISS. The post-Space Shuttle *Columbia* plan was to deliver *AMS-02* to the ISS by space shuttle in 2005 on station assembly mission **UF4.1**, but technical difficulties and shuttle scheduling issues added more delays.[11]

AMS-02 successfully completed final integration and operational testing at CERN in Geneva, Switzerland which included exposure to powerful nuclear particle beams generated by the CERN particle accelerators.[13] *AMS-02* was then shipped to ESA's European Space Research and Technology Centre (ESTEC) facility in the Netherlands where it arrived 16 February 2010. Here it underwent thermal vacuum, electromagnetic compatibility and electromagnetic interference testing. *AMS-02* was scheduled for delivery to the Kennedy Space Center in Florida, U.S.A. in late May 2010.[6] This was however postponed to August 26, as AMS-02 underwent final alignment beam testing at CERN.[14][15]



AMS-02 during final alignment testing at CERN just days before being airlifted to Cape Canaveral.



Beamline from SPS feeding 20 GeV positrons to AMS for alignment testing at the time of the picture.

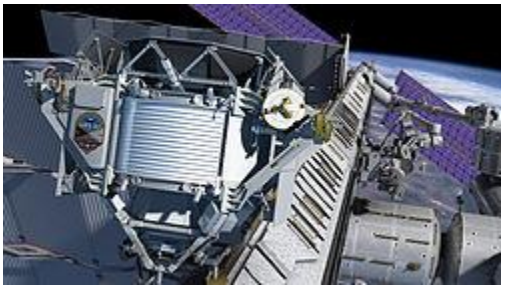
A cryogenic, superconducting magnet system was developed for the AMS-02. This was a critical technology, enabling a high sensitivity needed to achieve mission objectives.[16] Late in its development, poorly understood anomalous heating in the cryogenic magnet system was discovered. The anomalous heating would place additional demand on the cryogenic cooling. This characteristic significantly reduced the original system design lifetime and contributed to a decision to abandon the cryogenic system in favor of a previously developed but less capable permanent magnet system.[17]

With Obama administration plans to extend International Space Station operations beyond 2015, the decision has been made by AMS management to exchange the original AMS-02 superconducting magnet for the non-superconducting magnet previously flown on AMS-01. Although the non-superconducting magnet has a weaker field strength, its on-orbit operational time at ISS is expected to be 10 to 18 years versus only 3 years for the superconducting version. This additional data gathering time has been deemed more important than higher experiment sensitivity, despite the fact that the abandoned cryogenic system was originally described as critical technology to mission success.[18] Whether the ISS will operate long enough for AMS to take full advantage of its extended lifetime is also unclear.

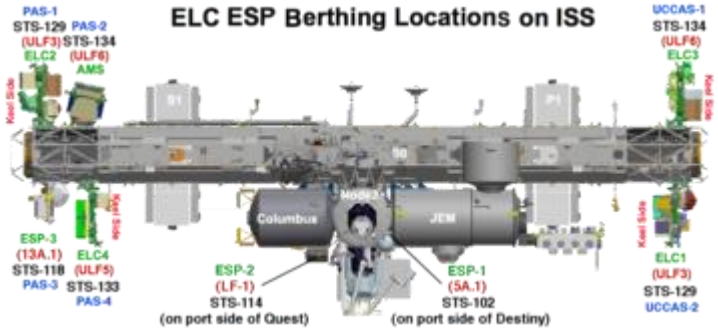
Program management

Activities relating to payload integration, launch, and deployment of *AMS-02* are managed by the Alpha Magnetic Spectrometer Project Office at NASA's Johnson Space Center in Houston, Texas, U.S.A.

Delivery and installation on the International Space Station



A computer generated image showing AMS-02 mounted to the ISS S3 Upper Inboard Payload Attach Site.



Location of the AMS on the International Space Station (upper left).

AMS-02 installed on the ISS.

AMS-02 was delivered to the International Space Station on May 19, 2011 as part of station assembly flight **ULF6** on shuttle flight STS-134, commanded by Mark Kelly.[19] It was removed from the shuttle cargo bay using the shuttle's robotic arm and handed off to the station's robotic arm for installation. *AMS-02* is mounted on top of the Integrated Truss Structure, on USS-02, the zenith side of the S3-element of the truss.[20]

Operations and data collection

About 1,000 cosmic rays are recorded by the instrument per second, generating about one GB/sec of data. This data is filtered and compressed to about 300 KB/sec for download to the operation centre POCC at CERN. In July 2012, it was reported that AMS-02 had observed over 18 billion cosmic rays.[8]

Specifications

- Mass: 14,809 lb (6,717 kg) or 14,839 lb (6731 kg)[*clarification needed*]
- Power: 2000–2500 watts
- Internal data rate: 10 Gbit/s
- Data rate to ground: 2 Mbit/s
- Primary mission duration: 10 to 18 years

- Magnetic field intensity: 0.125 teslas produced by a 1,200 kg $Nd_2Fe_{14}B$ permanent magnet[21]
- Original superconducting magnet: 2 coils of niobium-titanium at 1.8 K producing a central field of 0.87 teslas[22]
- AMS-02 flight magnet changed to non-superconducting AMS-01 version to extend experiment life and to solve reliability problems in the operation of the superconducting system

Cost

In 1999, after the successful flight of *AMS-01*, the total cost of the AMS program was estimated to be $33 million, with *AMS-02* planned for flight to the ISS in 2003.[23][*dead link*] After the Space Shuttle Columbia disaster in 2003, and after a number of technical difficulties with the construction of *AMS-02*, the cost of the program ballooned to an estimated $1.5 billion.[24]

The cost of the program was criticized heavily during the period when it appeared that it would not be flown,[9] and remains controversial.

Module design

The detector module consists of a series of detectors that are used to determine various characteristics of the radiation and particles as they pass through. Characteristics are determined only for particles that pass through from top to bottom. Particles that enter the detector at any other angles are rejected. From top to bottom the subsystems are identified as:[25]

- *Transition radiation detector* measures the velocities of the highest energy particles;
- *Upper time of flight counter*, along with the *lower time of flight counter*, measures the velocities of lower energy particles;
- *Star tracker* determines the orientation of the module in space;
- *Silicon tracker* measures the coordinates of charged particles in the magnetic field;
- *Permanent magnet* bends the path of charged particles so they can be identified;
- *Anti-coincidence counter* rejects stray particles that enter through the sides;
- *Ring imaging Cherenkov detector* measures velocity of fast particles with extreme accuracy;
- *Electromagnetic calorimeter* measures the total energy of the particles.

Scientific goals

The *AMS-02* will use the unique environment of space to advance knowledge of the Universe and lead to the understanding of its origin by searching for antimatter, dark matter and measuring cosmic rays.[20]

Antimatter

See also: Antimatter

Experimental evidence indicates that our galaxy is made of matter; however, scientists believe there are about 100–200 billion galaxies in the Universe and some versions of the Big Bang theory of the origin of the Universe require equal amounts of matter and antimatter. Theories that explain this apparent asymmetry violate other measurements. Whether or not there is significant antimatter is one of the fundamental questions of the origin and nature of the Universe. Any observations of an antihelium nucleus would provide evidence for the existence of antimatter in space. In 1999, *AMS-01* established a new upper limit of 10^{-6} for the antihelium/helium flux ratio in the Universe. *AMS-02* will search with a sensitivity of 10^{-9}, an improvement of three orders of magnitude over *AMS-01*, sufficient to reach the edge of the expanding Universe and resolve the issue definitively.

Dark matter

See also: Dark matter

The visible matter in the Universe, such as stars, adds up to less than 5 percent of the total mass that is known to exist from many other observations. The other 95 percent is dark, either dark matter, which is estimated at 20 percent of the Universe by weight, or dark energy, which makes up the balance. The exact nature of both still is unknown. One of the leading candidates for dark matter is the neutralino. If neutralinos exist, they should be colliding with each other and giving off an excess of charged particles that can be detected by *AMS-02*. Any peaks in the background positron, antiproton, or gamma ray flux could signal the presence of neutralinos or other dark matter candidates, but would need to be distinguished from poorly known confusing astrophysical signals.

Strangelets

See also: Strangelet

Six types of quarks (*up*, *down*, *strange*, *charm*, *bottom* and *top*) have been found experimentally; however, the majority of matter on Earth is made up of only *up* and *down* quarks. It is a fundamental question whether there exists stable matter made up of *strange* quarks in combination with *up* and *down* quarks. Particles of such matter are known as strangelets. Strangelets might have extremely large mass and very small charge-to-mass ratios. It would be a totally new form of matter. *AMS-02* may determine whether this extraordinary matter exists in our local environment.

Space radiation environment

Cosmic radiation is a significant obstacle to a manned space flight to Mars. Accurate measurements of the cosmic ray environment are needed to plan appropriate countermeasures. Most cosmic ray studies are done by balloon-borne instruments with flight times that are

measured in days; these studies have shown significant variations. *AMS-02* will be operative on the ISS for at least 3 years, gathering a large amount of accurate data and allowing measurements of the long term variation of the cosmic ray flux over a wide energy range, for nuclei from protons to iron. In addition to the understanding the radiation protection required for manned interplanetary flight, this data will allow the interstellar propagation and origins of cosmic rays to be identified.

Extended mission

According to its original design, *AMS-02* was to be returned to Earth on a shuttle flight after its superfluid helium supply (used to cool the superconducting magnet solenoid) was exhausted. Because the superconducting system could not be made to work reliably, lower sensitivity non-superconducting magnets were employed, eliminating the need for superfluid helium. The experiment additionally is too large and heavy to return to Earth after the retirement of the shuttle, and the plan is therefore now to leave the unit in place on the space station exterior.[*citation needed*]

Launch cancellation and restoration

For several years it was uncertain if *AMS-02* would ever be launched because it was not manifested to fly on any of the remaining Space Shuttle flights.[26] After the 2003 Columbia disaster NASA decided to reduce shuttle flights and retire the remaining shuttles by 2010. A number of flights were removed from the remaining manifest including the flight for *AMS-02*.[9] In 2006 NASA studied alternative ways of delivering *AMS-02* to the space station, but they all proved to be too expensive.[26]

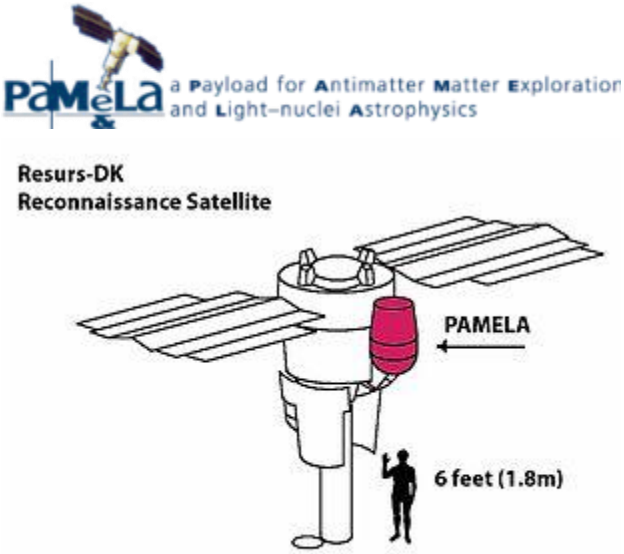
In May 2008 a bill was proposed to launch *AMS-02* to ISS on an additional shuttle flight in 2010 or 2011.[27] The bill was passed by the full House of Representatives on 11 June 2008.[28] The bill then went before the Senate Commerce, Science and Transportation Committee where it also passed. It was then amended and passed by the full Senate on 25 September 2008, and was passed again by the House on 27 September 2008.[29] It was signed by President George W. Bush on 15 October 2008.[30][31] The bill authorized NASA to add another space shuttle flight to the schedule before the space shuttle program is discontinued. In January 2009 NASA restored *AMS-02* to the shuttle manifest. On 26 August 2010, AMS-02 was delivered from CERN to the Kennedy Space Center by a Lockheed C-5 Galaxy,[32] and it was launched into space on STS-134 on 16 May 2011.

Spaceflight portal

- Scientific research on the ISS
- PAMELA is an Italian-international cosmic ray mission launched in 2006 with similar goals.[24]
- List of space telescopes (Astronomical Space Observatories)

Payload for Antimatter Matter Exploration and Light-nuclei Astrophysics

PAMELA



Organization	PAMELA group
Mission Type	Cosmic Ray
Host Satellite	Resurs DK1
Launch	15 June 2006
Launch vehicle	Soyuz-FG
Launch site	Baikonur Cosmodrome
Mission duration	3 years
Mission elapsed time	6 years, 3 months and 3 days
Mass	470 kg
Max length	1300 mm
Power consumption	335 Watts
Webpage	PAMELA homepage
Orbital elements (Resurs DK1)	
Inclination	70 degrees
Orbit	quasi-polar elliptical
Min altitude	360 km
Max altitude	604 km

Period	94.02 min

PAMELA (**Payload for Antimatter Matter Exploration and Light-nuclei Astrophysics**) is an operational cosmic ray research module attached to an Earth orbiting satellite. *PAMELA* was launched on 15 June 2006 and is the first satellite-based experiment dedicated to the detection of cosmic rays, with a particular focus on their antimatter component, in the form of positrons and antiprotons. Other objectives include long-term monitoring of the solar modulation of cosmic rays, measurements of energetic particles from the Sun, high-energy particles in Earth's magnetosphere and Jovian electrons. It is also hoped that it may detect evidence of dark matter annihilation.[1]

Development and launch

PAMELA is the largest device yet built by the Wizard collaboration, which includes Russia, Italy, Germany and Sweden and has been involved in many satellite and balloon-based cosmic ray experiments such as Fermi-GLAST. The 470 kg, US$32 million (EU€24.8 million, UK£16.8 million) instrument was originally projected to have a three year mission. However, this durable module is still operational and making significant scientific contributions after more than five years.

PAMELA is mounted on the upward-facing side of the Resurs-DK1 Russian satellite.[1] It was launched by a Soyuz rocket from Baikonur Cosmodrome on 15 June 2006. *PAMELA* has been put in a polar elliptical orbit at an altitude between 350 and 610 km, with an inclination of 70°.

Design

The apparatus is 1.3 m high, has a total mass of 470 kg and a power consumption of 335 W. The instrument is built around a permanent magnet spectrometer with a silicon microstrip tracker that provides rigidity and dE/dx information. At its bottom is a silicon-tungsten imaging calorimeter, a neutron detector and a shower tail scintillator to perform lepton/hadron discrimination. A Time of Flight (ToF), made of three layers of plastic scintillators, is used to measure the beta and charge of the particle. An anticounter system made of scintillators surrounding the apparatus is used to reject false triggers and albedo particles during off-line analysis.[2]

	Sensitivity[1]
Particle	**Energy Range**
Antiproton flux	80 MeV – 190 GeV
Positron flux	50 MeV – 270 GeV
Electron flux	up to 400 GeV
Proton flux	up to 700 GeV

Electron/positron flux	up to 2 TeV
Light nuclei (up to Z=6)	up to 200 GeV/n
Light isotopes (D, 3He)	up to 1 GeV/n
Antinuclei search	sensitivity better than 10^{-7} antiHe/He

Results

Preliminary data (released August 2008, ICHEP Philadelphia) indicate an excess of positrons in the range 10–60 GeV. This is thought to be a sign of dark matter annihilation:[3][4] hypothetical WIMPs colliding with and annihilating each other to form gamma rays, matter and antimatter particles.

The first two years of data were released in October 2008 in three publications.[5] The positron excess was confirmed and found to persist up to 90 GeV. Surprisingly, no excess of antiprotons was found. This is inconsistent with predictions from most models of dark matter sources, in which the positron and antiproton excesses are correlated.

A paper, published on 15 July 2011, confirmed earlier speculation that the Van Allen belt could confine a significant flux of antiprotons produced by the interaction of the Earth's upper atmosphere with cosmic rays.[6] The energy of the antiprotons has been measured in the range of 60–750 MeV. Cosmic rays collide with atoms in the upper atmosphere creating antineutrons, which in turn decay to produce the antiprotons. They were discovered in a part of the Van Allen belt closest to Earth.[7] When an antiproton interacts with a normal particle, both are annihilated. Data from PAMELA indicated that these annihilation events occurred a thousand times more often than would be expected in the absence of antimatter. The data that contained evidence of antimatter were gathered between July 2006 and December 2008.[8][9]

Sources of error

Between 1 and 100 GeV *PAMELA* is exposed to one hundred times as many electrons as antiprotons. At 1 GeV there are one thousand times as many protons as positrons and at 100 GeV ten thousand times as many. Therefore, to correctly determine the antimatter abundances, it is critical that PAMELA is able to reject the matter background. The PAMELA collaboration claimed in The electron hadron separation performance of the PAMELA electromagnetic calorimeter that less than one proton in 100,000 is able to pass the calorimeter selection and be misidentified as a positron when the energy is less than 200 GeV.

The ratio of matter to antimatter in cosmic rays of energy less than 10 GeV that reach PAMELA from outside the solar system depends on solar activity and in particular on the point in the 22 year solar cycle. The *PAMELA* team has invoked this effect to explain the discrepancy between their low energy results and those obtained by *CAPRICE*, *HEAT* and *AMS-01*, which were collected during that half of the cycle when the solar magnetic field had the opposite polarity. It is important to note that these results are consistent with the series of positron / electron measurements obtain by *AESOP*, which has spanned coverage over both polarities.

Nobeyama Radioheliograph

- Introduction
- Data Use Policy
- Gallery, Major Results
- Images & Movies
  - Today's Sun Image at Japan noon, Latest Image (Small), (Large)
  - Highlights of Recent Observations
  - Correlation Plots (Light Curves)
  - Daily Images & Movies
  - Event Images & Movies (strong), (weak), (GOES M or X)
  - Limb Events
  - 10min Images & Movies (full size), (half size)
  - Monthly Images
  - Synoptic Chart
  - Number of Flares Observed by NoRH

- Bibliography
- Archive, Softwares, and Manuals
- Nobeyama Solar Radio Observatory
- Acknowledgement

GeoEye...space agency...

GeoEye Inc. (NASDAQ: GEOY) (formerly **Orbital Imaging Corporation** or **ORBIMAGE**) is a commercial satellite imagery company based in Herndon, Virginia[3] that is the world's largest space imaging corporation owned by Cerberus Capital Management.[4]

The company was founded in 1992 as a division of Orbital Sciences Corporation in the wake of the 1992 Land Remote Sensing Policy Act which permitted private companies to enter the satellite imaging business. The division was spun off in 1997. It changed its name to GeoEye in 2006 after acquiring Denver, Colorado-based Space Imaging for $58 million.[4] Space Imaging was founded and controlled by Raytheon and Lockheed Martin. Its principal asset was the IKONOS satellite.

Although ORBIMAGE's first chairman was Orbital chairman David W. Thompson, and Orbital at the time owned more than 60 percent of the stock, it no longer has a substantial interest in the new company.[5]

GeoEye provides 253,000,000 square kilometres (98,000,000 sq mi) of satellite map images to Microsoft and Yahoo! search engines. Google has exclusive online mapping use of the new GeoEye-1 satellite.[6] It is a major supplier to the National Geospatial-Intelligence Agency.

GeoEye's headquarters are in Herndon, Virginia. Satellite Operations are conducted in Herndon, Virginia and in Thornton, Colorado. The location in Saint Louis, Missouri provides additional image processing. There are multiple ground stations located worldwide.

GeoEye's primary competitors are DigitalGlobe and Spot Image.

Since 2001, its chairman has been former astronaut and Lieutenant General James A. Abrahamson.[7]

In 2011, GeoEye was inducted into the Space Foundation's Space Technology Hall of Fame[8] for its role in advancing commercial Earth-imaging satellites.[9]

Satellites

GeoEye operates its own fleet of Earth observation satellites, which provide visible and near-infrared images of land and sea at resolutions below 1 m (3.3 ft).

IKONOS

Main article: IKONOS

Launched in 1999 by Space Imaging, IKONOS collects 82 cm (32 in) panchromatic and 3.2 m (10 ft) multispectral data at a rate of over 2,000 km^2 (770 sq mi) per minute. IKONOS orbits the Earth every 98 minutes at an altitude of approximately 680 km (420 mi). It travels a sun-synchronous orbit, passing a given longitude at 10:30 AM local time. IKONOS is operated out of Thornton, Colorado. It derived its name from the Greek term *eikōn' (pronounced eikona) for image.*[10]

OrbView-2

The satellite also called SeaStar was launched in 1997 by ORBIMAGE, OrbView-2 collects color imagery of the Earth's entire land and ocean surfaces on a daily basis. Commercial fishing vessels use OrbView-2 data for detecting oceanographic conditions used to create fishing maps. The satellite also provides broad-area coverage in 2,800 kilometer-wide swaths, which are routinely used in naval operations, environmental monitoring, and global crop assessment applications. OrbView-2 carries NASA's SeaWiFS sensor. OrbView-2 is operated out of Herndon, Virginia.[11] It stopped collecting data on 11 December 2010.[12]

OrbView-3

Launched in 2003 by ORBIMAGE, OrbView-3 acquired 1 m (3.3 ft) panchromatic and 4 m (13 ft) multispectral imagery in an 8-kilometer-wide swath. The satellite collected up to 210,000 km^2 (81,000 sq mi) of imagery each day. It revisited each location on Earth in less than three days with the ability to collect data up to 50 degrees off nadir. Similar to IKONOS, this satellite passes a given longitude at 10:30 AM local time.

On April 23, 2007, GeoEye, Inc. filed a Form 8-K to announce that its OrbView-3 satellite is permanently out of service. Though GeoEye remained in control of the satellite, it no longer produced usable imagery.[13][14] The spacecraft decayed on March 13, 2011 via a controlled reentry into the broad area Pacific Ocean.

GeoEye-1

Main article: GeoEye-1

GeoEye-1 (Former name OrbView 5) launched on September 6, 2008 at 11:50:57 a.m. PDT (1850:57 UTC). The satellite separated successfully from its Delta II launch vehicle at 12:49

p.m. PDT (1949 UTC), 58 minutes and 56 seconds after launch.[15] The satellite provides 41 centimetres (16 in) panchromatic and 1.65 meter multispectral imagery in 15.2 km swaths. The spacecraft is intended for a sun-synchronous orbit at an altitude of 425 miles (684 km) and an inclination of 98 degrees, with a 10:30 a.m. equator crossing time. GeoEye-1 can image up to 60 degrees off nadir. It is operated out of Herndon, Virginia and was built in Arizona by General Dynamics Advanced Information Systems.

GeoEye-2

Main article: GeoEye-2

GeoEye-2, which has a contract with ITT Corporation for the imaging is scheduled launch in 2013 and has a planned resolution of 25 cm (9.8 in)[6] Lockheed Martin has been selected to build the satellite platform over General Dynamics [16]

Aerial imagery

GeoEye expanded into aerial imagery in March 2007, with the purchase of **MJ Harden** from General Electric Company.[17] MJ Harden, based in Mission, KS, is now a wholly owned subsidiary that operates two aircraft that carry a digital mapping camera (DMC) and a sophisticated LiDAR imaging system. MJ Harden was founded by Milton J. Harden in 1956 to provide Photogrammetry services.[18] GE Power Systems bought the company in 2003.

DigitalGlobe···space agency

DigitalGlobe (NYSE: DGI), of Longmont, Colorado, USA, is a commercial vendor of space imagery and geospatial content, and operator of civilian remote sensing spacecraft. The company went public on the New York Stock Exchange on 14 May 2009, selling 14.7 million shares at $19.00 each to raise $279 million in capital.[1]

Origins

Worldview Imaging Corporation was founded in January 1992 in Oakland, California in anticipation of the 1992 Land Remote Sensing Policy Act (enacted in October 1992) which permitted private companies to enter the satellite imaging business.[2] Its founder was Dr Walter Scott, who was joined by co-founder and CEO Doug Gerull in late 1992, The company had received the first high resolution commercial remote sensing satellite license issued under the

1992 Act. The company was initially funded with private financing from Silicon Valley sources and interested corporations in N. America, Europe, and Japan. Dr. Scott was head of the Lawrence Livermore Laboratories "Brilliant Pebbles" and "Brilliant Eyes" projects which were part of the Strategic Defense Initiative. Doug Gerull was the executive in charge of the Mapping Sciences division at the Intergraph Corporation.[3] The company's first remote sensing license from the United States Department of Commerce allowed it to build a commercial remote sensing satellite capable of collecting images with 3 m (9.8 ft) resolution.[2]

In 1995, the company became EarthWatch Incorporated, merging WorldView with Ball Aerospace & Technologies Corp.'s commercial remote sensing operations.[4] In September 2001, EarthWatch became DigitalGlobe.[5]

In 2011, DigitalGlobe was inducted into the Space Foundation's Space Technology Hall of Fame for its role in advancing commercial Earth-imaging satellites.[6]

Satellites

Early Bird 1

Early Bird 1 was launched for Earth Watch Inc. launched December 24 1997 from the Svobodny Cosmodrome by a Start-1 launch vehicle.[7] It included a panchromatic camera with a 3 m (9.8 ft) resolution and a multispectral camera with a 15 m (49 ft) resolution. Early Bird 1 was the first commercial satellite to be launched from the Svobodny Cosmodrome.

QuickBird

Main article: QuickBird

QuickBird, launched on October 18, 2001,[4] is DigitalGlobe's primary satellite. It was built in partnership with Ball Aerospace and Orbital Sciences, and launched by a Boeing Delta II. It is in a 450 km altitude, –98 degree inclination sun-synchronous orbit. An earlier launch attempt resulted in the loss of QuickBird-1. It included a panchromatic camera with a 60 cm (24 in) resolution and a multispectral camera with a 2.4 m (7 ft 10 in) resolution.

WorldView-1

Ball Aerospace built WorldView-1.[8] It was launched on September 18, 2007 from Vandenberg Air Force Base on a Delta II 7920-10C. Launch services were provided by United Launch Alliance. The National Geospatial-Intelligence Agency is expected to be a major customer of WorldView-1 imagery.[9] It included a panchromatic only camera with a 50 cm (20 in) maximum resolution. It was the most powerful commercial satellite when launched.

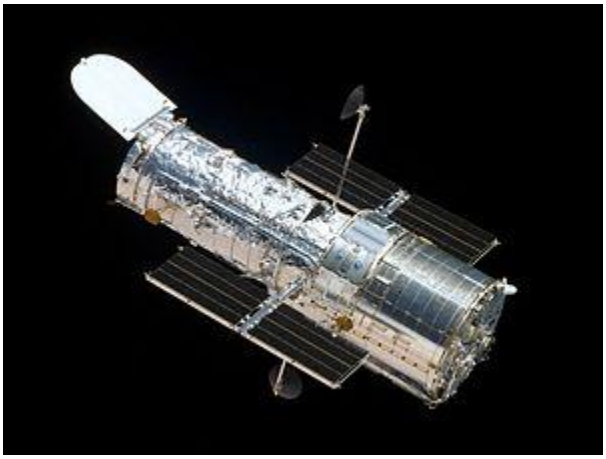
WorldView-2

Ball Aerospace built WorldView-2. It was launched on October 8, 2009. DigitalGlobe partnered with Boeing commercial launch services to deliver WorldView-2 into a sun-synchronous orbit.[10][11] The satellite includes a panchromatic sensor with a 46 cm (18 in) maximum resolution and a multispectral sensor of 184 cm (72 in)[12]

Customers

DigitalGlobe's customers range from urban planners, to the U.S. federal agencies, including NASA[5] and the United States Department of Defense's National Geospatial-Intelligence Agency (NGA).[13] Much of Google Earth and Google Maps high resolution-imagery is provided by DigitalGlobe,[14] as is imagery used in TerraServer.[15] DigitalGlobe's main competitors are GeoEye (formerly Orbimage and Space Imaging) and Spot Image.

…NASA GETS TWO MILITARY SPY TELESCOPES FOR ASTRONOMY…



The secretive government agency that flies spy satellites has made a stunning gift to NASA: two exquisite telescopes as big and powerful as the Hubble Space Telescope. They've never left the ground and are in storage in Rochester, N.Y.

It's an unusual technology transfer from the military-intelligence space program to the better-known civilian space agency. It could be a boost for NASA's troubled science program, which is groaning under the budgetary weight of the James Webb Space Telescope, still at least six years from launch.

Or it could be a gift that becomes a burden. NASA isn't sure it can afford to put even one of the two new telescopes into orbit.

The telescopes were built by private contractors for the National Reconnaissance Office, one of 16 U.S. intelligence agencies. The telescopes have 2.4-meter (7.9-foot) mirrors, just like the Hubble, but they have 100 times the field of view. Their structure is shorter and squatter.

They're "space qualified," as NASA puts it, but they're a long way from being functioning space telescopes. They have no instruments — there are no cameras, for example. More than that, they lack a funded mission and all that entails, such as a scientific program, support staff, data analysis and office space. They will remain in storage while NASA mulls its options.

"It's great news," said NASA astrophysics director Paul Hertz. "It's real hardware, and it's got really impressive capabilities."

The announcement Monday raised the obvious question of why the intelligence agency would no longer want, or need, two Hubble-class telescopes. A spokeswoman, Loretta DeSio, provided information sparingly.

"They no longer possessed intelligence-collection uses," she said of the telescopes.

She confirmed that the hardware represents an upgrade of Hubble's optical technology.

"The hardware is approximately the same size as the Hubble but uses newer, much lighter mirror and structure technology," DeSio said. She added, "Some components were removed before the transfer."

Which components? "I can't tell you that," she said.

The telescopes have been declassified, though they remain sufficiently sensitive that neither the NRO or NASA would provide a photograph of them. At a presentation to scientists Monday in Washington, Alan Dressler, an astronomer at the Carnegie Institution for Science, showed an image of one of the telescopes, but it was so thoroughly blacked out — redacted for national security reasons — that the audience burst into laughter.

The surprise announcement was a reminder that NASA isn't the only space enterprise in the government. Analysts believe that the United States spends more money on military and intelligence space operations than on civilian space efforts.

The two NRO telescopes may be versions of the KH-11 Kennan satellites that the agency has been putting into orbit since 1976, according to a space analyst familiar with both civilian and military hardware. The analyst said that in recent years, the NRO has decided to switch to surveillance satellites that have a broader field of view than the older models. Instead of essentially looking down through a straw at the Earth's surface, the new technology looks down through a garden hose, the analyst said.

“This is going to be top-quality hardware,” said the analyst, who spoke on the condition of anonymity because of the sensitive nature of the topic. “They’re not state-of-the-art spy satellites, but they are probably still state-of-the-art optics.”

DeSio, the NRO spokeswoman, said the telescopes were built in the late 1990s and early 2000s.

Spotting a dime from space

These are formidable eyes in the sky, apparently. NASA official Michael Moore said that if the Hubble Space Telescope were pointed at the surface of the Earth instead of at outer space, “you could see a dime sitting on top of the Washington Monument.”

The spy telescopes have a feature that civilian space telescopes lack: a maneuverable secondary mirror that makes it possible to obtain more-focused images, said David Spergel, a Princeton University astrophysicist and a co-chair of the National Academies of Science committee on astronomy and astrophysics.

The new telescopes are “actually better than the Hubble. They’re the same size, but the optical design is such that you can put a broader set of instruments on the back,” he said.

Spergel is among the scientists who in 2010 produced the “decadal survey,” which listed the top priorities in astronomy. At the top of the list was a new space telescope that could be used to look for extrasolar planets and to study “dark energy,” the mysterious cosmic force that seems to be causing the universe to expand at an accelerating rate.

NASA has a plan for such a telescope, called the Wide-Field Infrared Survey Telescope (WFIRST). But the program has effectively been put on hold because of the dismal state of the space agency’s science budget.

The Webb has gobbled up money that might have gone to other projects. It’s a jumbo telescope designed to orbit 1 million miles from Earth, where it would observe the mid-infrared portion of the electromagnetic spectrum. With that capability, it could gather light from the farthest reaches of the universe. But it’s not scheduled to launch until 2018, more than four years past the original launch target, and its projected cost is nearing $9 billion.

WFIRST was envisioned as a much less expensive telescope with a relatively modest light-collecting mirror, just 1.5 meters (4.9 feet). One of the new NRO telescopes, with a bigger mirror, would give WFIRST an upgrade in capability.

But everything comes down to money.

No money for a mission

“NASA does not have in its current budget the funding necessary to develop a space telescope mission using these new telescopes,” Hertz, the astrophysics director, said in a conference call.

He said that, using plausible budgets, 2024 would be the earliest date to launch one of the two telescopes unless the agency received additional funding from Congress. “Any dates earlier, like 2019 or 2020, is if money is no object,” Hertz said.

And that is the projection for just one of the telescopes. The other seems destined to remain firmly on the ground for the foreseeable future.

“We don’t at this point in time anticipate ever being rich enough to use both of them, but it sure would be fun, wouldn’t it?” Hertz said.

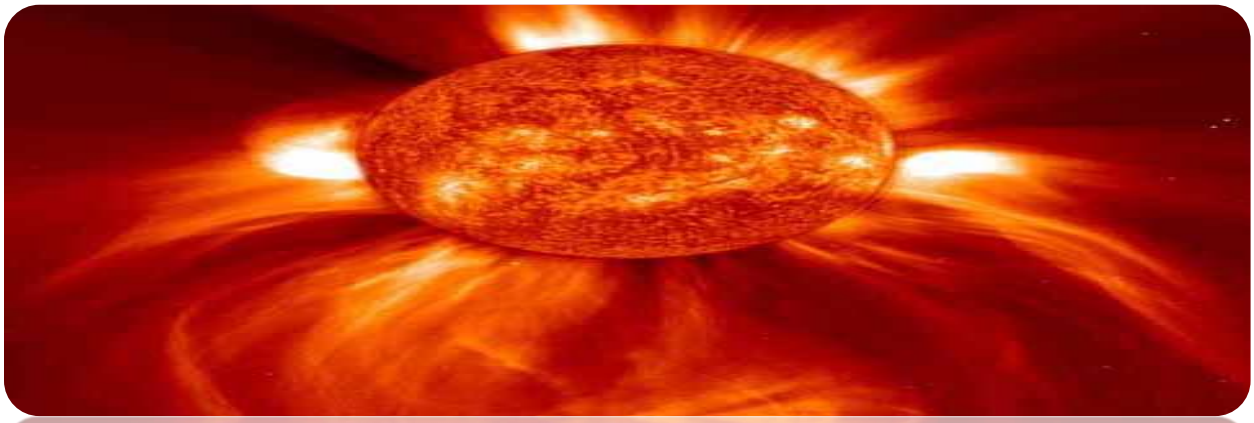
The value of a space telescope sitting in storage is hard to estimate, but NASA officials said that having a finished piece of telescope hardware would shave about $250 million off a future mission. It would also shorten the timeline on a project by several years.

“The thing that takes the longest to build is the telescope,” Spergel said.

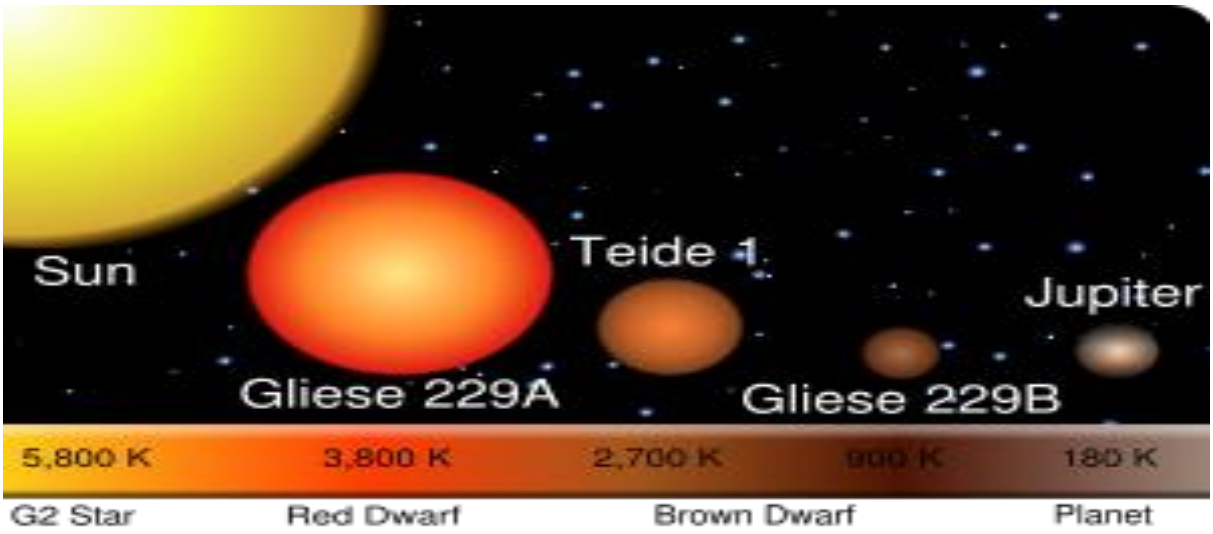
NASA’s windfall takes the pain out of the planned demise of the Hubble. The storied telescope, launched in 1990 and still operating, will lose functionality in coming years. NASA, lacking a space shuttle, has neither the means nor the money to repair the Hubble again. At some point, it will return to the atmosphere in a controlled de-orbit, crash into the Pacific and sink to the bottom of the ocean.

“Instead of losing a terrific telescope, you now have two telescopes even better to replace it with,” Spergel said.

Asked whether anyone at NASA was popping champagne, the agency’s head of science, John Grunsfeld, answered, “We never pop champagne here; our budgets are too tight.”



...Has Planet X ever been in the media?...



There was a big media blitz when first hypothesized back in the 1980's. The more of a realization it became, the more nervous many started to become. After all, this planet was already identified over 6000 years ago. When the possible ramifcations became apparant, the whole science of Astronomy seemed to fall out of sight. So, here's so clues as to if Planet X could be out there, just like the Sumerians and Maya say it is.

Astronomy - Search for the Tenth Planet Dec 1981
Astronomers are readying telescopes to probe the outer reaches of our solar system for an elusive planet much larger than Earth. Its existence would explain a 160-year-old mystery. ... The pull exerted by its gravity would account for a wobble in Uranus' orbit that was first detected in 1821 by a French astronomer, Alexis Bouvard. Beyond Pluto, in the cold, dark regions of space, may lie an undiscovered tenth planet two to five times the size of Earth. Astronomers at the U.S. Naval Observatory (USNO) are using a powerful computer to identify the best target zones, and a telescopic search will follow soon after. ... Van Flandern thinks the tenth planet may have between two and five Earth masses and lie 50 to 100 astronomical units from the Sun.

(An astronomical unit is the mean distance between Earth and the Sun.) His team also presumes that, like Pluto's, the plane of the undiscovered body's orbit is tilted with respect to that of most other planets, and that its path around the Sun is highly elliptical.

New York Times June 19, 1982
A pair of American spacecraft may help scientists detect what could be a 10th planet or a giant object billions of miles away, the national Aeronautics and Space Administration said Thursday. Scientists at the space agency's Ames Research Center said the two spacecraft, Pioneer 10 and 11, which are already farther into space than any other man-made object, might add to knowledge of a mysterious object believed to be beyond the solar system's outermost known planets.

The space agency said that persistent irregularities in the orbits of Uranus and Neptune "suggest some kind of mystery object is really there" with its distance depending on what it is. If the mystery object is a new planet, it may lie five billion miles beyond the outer orbital ring of known planets, the space agency said. If it is a dark star type of objet, it may be 50 billion miles beyond the known planets; if it is a black hole, 100 billion miles. A black hole is a hypothetical body in space, believed to be a collapsed star so condensed that neither light nor matter can escape from its gravitational field.

Newsweek Does the Sun Have a Dark Companion?June 28 1982
When scientists noticed that Uranus wasn't following its predicted orbit for example, they didn't question their theories. Instead they blamed the anomalies on an as yet unseen planet and, sure enough, Neptune was discovered in 1846. Now astronomers are using the same strategy to explain quirks in the orbits of Uranus and Neptune.

According to John Anderson of the Jet Propulsion Laboratory in Pasadena, Calif., this odd behavior suggests that the sun has an unseen companion, a dark star gravitationally bound to it but billions of miles away. ... Other scientists suggest that the most likely cause of the orbital snags is a tenth planet 4 to 7 billion miles beyond Neptune.

A companion star would tug the outer planets, not just Uranus and Neptune, says Thomas Van Flandern of the U.S Naval Observatory. And where he admits a tenth planet is possible, but argues that it would have to be so big - a least the size of Uranus - that it should have been discovered by now. To resolve the question, NASA is staying tuned to Pioneer 10 and 11, the planetary probes that are flying through the dim reaches of the solar system on opposite sides of the sun.

New York Times January 30, 1983
Something out there beyond the farthest reaches of the known solar system seems to be tugging at Uranus and Neptune. Some gravitational force keeps perturbing the two giant planets, causing irregularities in their orbits. The force suggests a presence far away and unseen, a large object that may be the long- sought Planet X. ... The last time a serious search of the skies was made it led to the discovery in 1930 of Pluto, the ninth planet.

But the story begins more than a century before that, after the discovery of Uranus in 1781 by the English astronomer and musician William Herschel. Until then, the planetary system seemed to end with Saturn.

As astronomers observed Uranus, noting irregularities in its orbital path, many speculated that they were witnessing the gravitational pull of an unknown planet. So began the first planetary search based on astronomers predictions, which ended in the 1840's with the discovery of Neptune almost simultaneously by English, French, and German astronomers.

But Neptune was not massive enough to account entirely for the orbital behavior of Uranus. Indeed, Neptune itself seemed to be affected by a still more remote planet. In the last 19th century, two American astronomers, Willian H. Pickering and Percival Lowell, predicted the size and approximate location of the trans-Neptunian body, which Lowell called Planet X. Years later, Pluto was detected by Clyde W. Tombaugh working at Lowell Observatory in Arizona. Several astronomers, however, suspected it might not be the Planet X of prediction.

Subsequent observation proved them right. Pluto was too small to change the orbits of Uranus and Neptune, the combined mass of Pluto and its recently discovered satellite, Charon, is only 1/5 that of Earth's moon.

Recent calculations by the United States Naval Observatory have confirmed the orbital perturbation exhibited by Uranus and Neptune, which Dr. Thomas C Van Flandern, an astronomer at the observatory, says could be explained by "a single undiscovered planet". He and a colleague, Dr. Richard Harrington, calculate that the 10th planet should be two to five times more massive than Earth and have a highly elliptical orbit that takes it some 5 billion miles beyond that of Pluto - hardly next-door but still within the gravitational influence of the Sun.

US News World Report Planet X - Is It Really Out There? Sept 10, 1984 Shrouded from the sun's light, mysteriously tugging at the orbits of Uranus and Neptune, is an unseen force that astronomers suspect may be Planet X - a 10th resident of the Earth's celestial neighborhood. Last year, the infrared astronomical satellite (IRAS), circling in a polar orbit 560 miles from the Earth, detected heat from an object about 50 billion miles away that is now the subject of intense speculation.

"All I can say is that we don't know what it is yet," says Gerry Neugesbeuer, director of the Palomar Observatory for the California Institute of Technology. Scientists are hopeful that the one-way journeys of the Pioneer 10 and 11 space probes may help to locate the nameless body.

PART 5: DARK STAR IMAGINING...

Southpole telescope notes...

Astrophysics and Cosmology

Group Overview

The research of the CMU Astrophysics and Cosmology group covers a wide range of problems in observational cosmology. From the study of the earliest energy emission in the universe -the Cosmic Background Radiation- to the evolution of galaxies and the formation of large-scale structure. We are part of the worldwide scientific effort to put constraints on the basic cosmological parameters that describe the evolution of the universe. Many of these parameters are expected to be tied down over the next decade using data from the current and planned ground-based and space-based observatories. The analysis of these new data sets is very

challenging and will require both the development of highly sophisticated numerical simulations and the application of the latest tools in data-mining, statistics, and computer science.

Group members have access to data from a variety of major telescopes and space missions, including the Sloan Digital Sky Survey, the Chandra and XMM X-ray satellites, and the Hubble Space Telescope. CMU is a partner in The National Virtual Observatory and in the 11m SALT telescope in South Africa. CMU also owns a 2m sub-millimeter telescope, Viper, at the South Pole. Computer resources are vital to the success of any modern astrophysics group. The CMU group owns a state-of-the-art Beowulf cluster and has access to the TeraScale facilities of the Pittsburgh Super Computing center.

Recent results include those in strong lensing; the Sunyaev-Zeldovich effect; the X-ray background; numerical simulations; and ``baryon wiggles''. The group has also made preliminary measurements of many of the fundamental cosmological parameters including Hubble's Constant, Omega Matter, Omega Total and sigma-8. The group has major involvements in some of the most exciting projects in cosmology and extra-Galactic astronomy e.g. ACBAR, AMiBA, MDS, NVO, SDSS and XCS and is well placed to be a world leader in the race to the underlying cosmological model.

Member Research Thrusts

Rupert Croft's main research interests are in computational cosmology, involving both simulations and the analysis of large surveys. He primarily focuses on the physics of the intergalactic medium, its use as a probe of cosmology and of galaxy and quasar formation. He is a member of the SDSS-III survey of galaxies and quasar absorption lines which aims to measure dark energy parameters using large scale baryonic oscillatory features as a standard ruler. Croft also works on the interaction between matter and radiation in the intergalactic medium, on the re-ionization of the Universe, and predictions for future 21cm radio observations of this high redshift cosmological frontier. He makes use of the McWilliams Center's high performance computing facilities, including Warp, the 700 core cluster to perform cosmological hydrodynamic and radiative transfer simulations.

Tiziana Di Matteo is a theorist with expertise in both high energy astrophysics and cosmology. Her recent interests focus on state-of-the-art cosmological simulations of galaxy formation including detailed modeling of the impact of black hold feedback on structure formation. She has consistently been awarded large allocations of time on the largest national computing facilities and also makes use of the computational facilities of the McWilliams Center for Cosmology.

Richard Griffiths' research programs are in space astronomy, especially 'deep surveys' using current earth-orbiting optical and X-ray telescopes, part of the work of observational cosmology. In a 'deep survey' a telescope is pointed at a blank region of sky for about a week, in order to find the faintest and most distant objects that the telescope can detect. He is currently involved in the results of deep X-ray surveys using the two large X-ray telescopes launched in 1999, the Chandra X-ray Observatory, CXO (NASA) and the XMM-Newton satellite (European Space Agency). He uses some of the world's largest telescopes to identify the kinds of galaxies which are the greatest producers of X-rays. Griffiths has also led the Medium Deep Survey, a Key Project using the Hubble Space Telescope, and the largest program of observations ever undertaken with the Hubble.

Shirley Ho is a cosmologist whose interest ranges from theory to observations, and whose research involves both simulations and analysis of large scale structure surveys such as the Sloan Digital Sky Survey III or of the cosmic microwave background data from Planck HFI and LFI. She primarily works on utilizing the large scale structure and cosmic microwave background to understand the beginning of the universe, the dark components of the universe such as dark energy and dark matter and its lighter but equally elusive contents such as neutrinos and the evaluation of the universe. Her recent interest focuses on the use of a standard ruler called Baryon Acoustic Oscillations via various large scale structure tracers, such as the 3D clustering tracer of large scale structure.

Jeffrey Peterson's group carries out cosmological observations using the 21 cm emission line of neutral hydrogen. The group is involved in projects using existing telescopes to make three dimensional maps of 21 cm emission for redshifts around ten. These maps will be used to study the first stars and their interaction with surrounding gas. The team also designs and builds 21 cm telescopes. In particular, the group is working to build the Cylinder Radio Telescope in Morocco. This 10,000 square meter telescope will map most of the sky at redshifts near one in order to constrain models of Dark Energy.

Hy Trac is a theoretical and computational cosmologist whose scientific interests include cosmic evolution and structure formation. He is actively working on understanding how the first generation of stars and galaxies re-ionize the universe and how the intergalactic medium can be studied using the Lyman alpha forest. As a member of the Atacama Cosmology Telescope (ACT) project, he is studying how galaxy clusters can be discovered through the Sunyaev-Zel'dovich effect. His research also focuses on the development and application of N-body, hydrodynamic, and radiative transfer algorithms.

South Pole Telescope (SPT) — America's New Planet X Tracker?

America is now spending huge sums to deploy the massive The South Pole Telescope (SPT) in Antarctica. The final installation will be the size of a mini-mall and will require a massive C-130 airlift effort to transport pre-assembled modules and a large staff to the most desolate, inhospitable and inaccessible region of the world.

Why? Why is America spending a massive fortune to transport this massive facility with a massive C-130 airlift operation to the most desolate, inhospitable and inaccessible region of the world? Why NOW?

Because Planet X / Nibiru was first sighted in 1983 and this discovery spurred the USA to build the SPT — humanity's new Planet X tracker. And this is where astronomers will find their ultimate Kodak moment. A key person in revealing this is a former US intelligence officer by the name of John Maynard. With regards to this article, his explanation of how our government first began tracking Planet X / Nibiru in 1983 is now being corroborated with the deployment of the South Pole Telescope (SPT) in Antarctica.

···SPT Mystery Teams···

In mid-December 2007, long-time *Yowusa.com supporter* **Christopher Ferri**, Founder and CEO of a-s-s-e-t.com, an online merchant banking system based in New Zealand, contacted us with some very interesting information.

According to Christopher, several of his merchant members in New Zealand were discussing a troubling, new trend at the *Amundsen-Scott South Pole Station* in Antarctica, where the SPT is located.

In the normal course of events, C-130 flights to the Station make a stop in New Zealand to refuel and pick up additional supplies provided by local merchants and to provide transport for scientists traveling to the Station.

However, in December 2007, a troubling trend emerged. Secretive teams of researchers began arriving at the Station on non-stop C-130 flights from the US. While the distance is considerable, it is manageable, given that the C-130 is a military transport with mid-air refueling capabilities.

Christopher reported that his New Zealand merchants were hearing stories from non-American researchers, stating that these SPT Mystery Teams were showing up unannounced on non-stop flights to work for brief periods at the SPT. During those episodes, the SPT Mystery Teams kept to themselves and then left as they had come.

Given that the *Amundsen-Scott South Pole Station* is a large, *civilian* international research base, the mysterious comings and goings of these special US teams was obviously troubling for civilian researchers from other countries.

The South Pole Telescope (SPT) was recently completed in 2007. It was funded by the National Science Foundation, and cost $150 million dollars to complete. Construction took place from 2006 to 2007. Just one year. That's pretty fast for a project of this magnitutude and sensitivity. Especially in a harsh environment like the South Pole. It seems like someone was in a hurry.

The SPT is a Radio Frequency (RF) telescope that operates in the 70GHZ - 300GHZ range. The super high frequencies that this receiver is designed to pick up are susceptible to interference and distortion from solar radiation swings and water vapor. the South Pole is therefore an ideal location to place this sensitive listening device. The sun in Antarctica hardly rises or sets. Its radiation is therefore fairly stable. Meanwhile, the elevation at the South Pole - 1.7 miles above sea level - also serves to minimize anomalies from things like water vapor and clouds.

The SPT's stated purpose is to, get this, 'listen for distant clusters of galaxies'. Give me a break! Listening for distant twinkles?! At a time when our problems are so tangible right here on Earth?! Even the United States wouldn't squander money like that. suffice it to say that if no executives were able to use the $150 million to take bonuses with, then the SPT must be pretty serious.

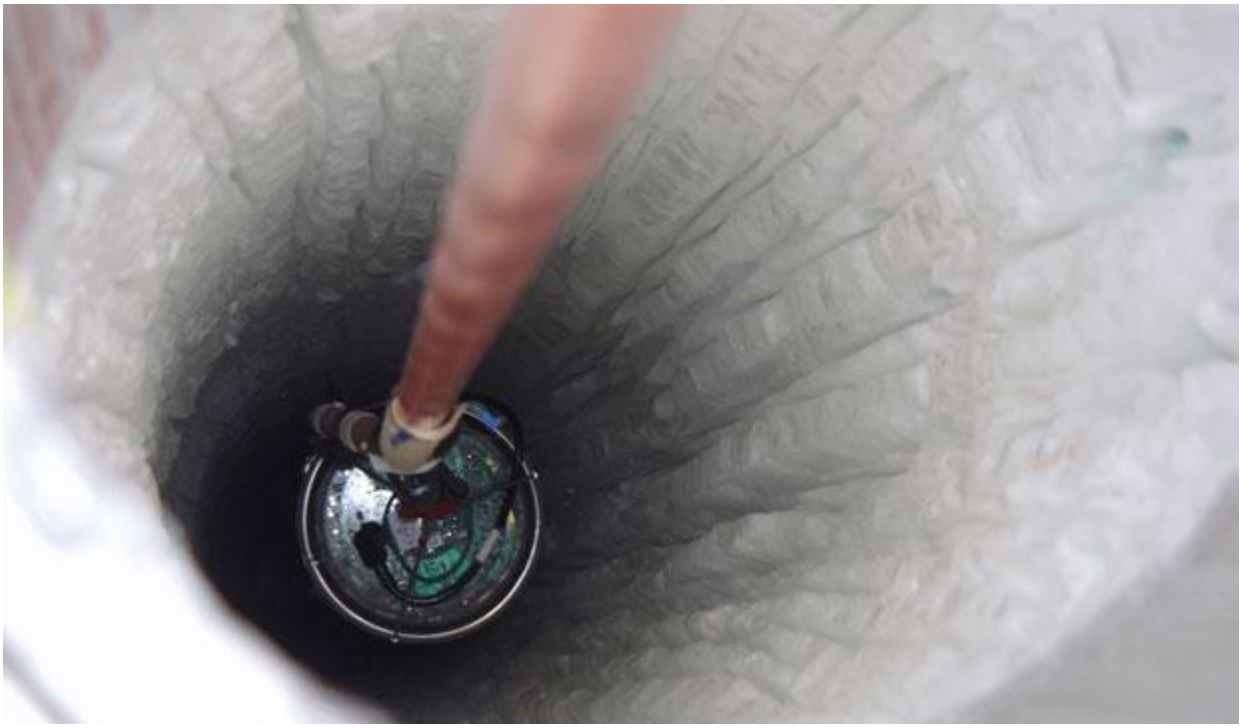
So serious in fact, that there are reportedly secretive groups who visit the South Pole site, gather data, and leave with out a word. What's so secret and urgent about remote galactic clusters that are probably thousands of lightyears away? I don' buy it. I believe that the SPT was built for the specific purpose of tracking Nibiru and attempting to determine the time of arrival to it's orbital perigee.

The fact is, a large planetary body like a brown dwarf star for example, would be massive enough to upset our solar equilibrium. Scientists have gone on record stating that things such as increased solar flare activity would be a given should such an object travel too close to our Sun. Increased solar flare activity would readily explain global warming and the extreme meteorological events that have taken place over the last few years. Another side effect of a large planetary or external solar flyby would be a polar shift here on earth. The topic of Earth Polar Shift has all of a sudden become highly talked about among astrophysicists. And understandably so. Since a very slight shift in the position of the Earth's poles would be enough to cause an Extinction Level Event. So perhaps the name 'Destroyer' is a fitting one. I suggest we keep our eyes peeled. Though not that it would do much good.

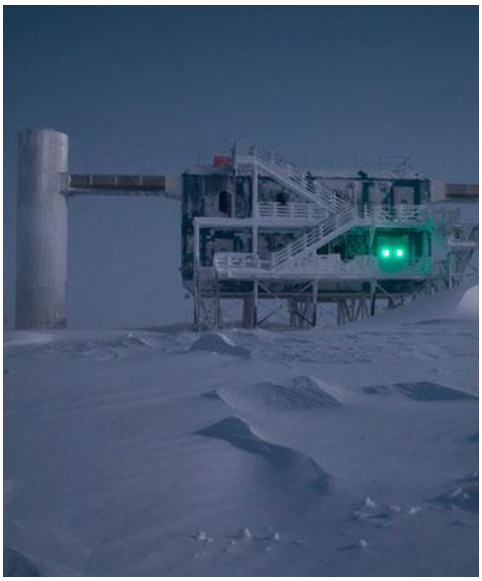
In any case, it appears that the National Security Agency (NSA), or whatever secret service people are making regular visits to the SPT site, are doing so for that exact purpose. To watch and listen for an large stellar object that is no doubt approaching. If and when they decide make the public aware of their findings is uncertain at best. Therefore we have to do our own watching.

That is the purpose of this blog. To expose the truth about Planet X aka Nibiru aka the Destroyer. And see if we can figure out how to survive what seems to be an impending flyby. Because too many factors indicate that Nibiru is real, and it is moving closer to us by the minute.

Higgs find gives focus to 2.4km telescope



The digital optical module for the IceCube South Pole Neutrino Observatory is lowered into the Antarctic ice.



Reuters
SEARCHING: The IceCube Lab at the South Pole houses the world's biggest telescope. Scientists are using it to learn about neutrinos.

Scientists are using the world's biggest telescope, buried deep under the South Pole, to try to unravel the mysteries of tiny particles known as neutrinos, hoping to shed light on how the universe was made.

The mega-detector, called IceCube, took 10 years to build 2400 metres below the Antarctic ice.

At one cubic kilometre, it is bigger than the Empire State building, the Chicago Sears Tower - now known as Willis Tower - and Shanghai's World Financial Center combined.

Designed to observe neutrinos, which are emitted by exploding stars and move close to the speed of light, the telescope is attracting new attention in the wake of last week's discovery of a particle that appears to be the Higgs boson - a basic building block of the universe.

"You hold up your finger and a hundred billion neutrinos pass through it every second from the sun," said Jenni Adams, a physicist at the University of Canterbury in New Zealand, who works on IceCube.

IceCube is essentially a string of light detectors buried in the ice through hot water drilling.

When neutrinos, which are everywhere, interact in the ice, they produce charged particles that then create light, which can be detected.

The ice acts as a net that isolates the neutrinos, making them easier to observe. It also protects the telescope from potentially damaging radiation.

"If a supernova goes off in our galaxy now, we can detect hundreds of neutrinos with IceCube," Adams told reporters at the International Conference on High Energy Physics in Melbourne.

"We won't be able to see them individually, but the whole detector will just light up like a massive fireworks display."

Scientists are attempting to track the particles to discover their points of origin, in the hope that will give clues on what happens in space, particularly in unseen parts of the universe known as dark matter.

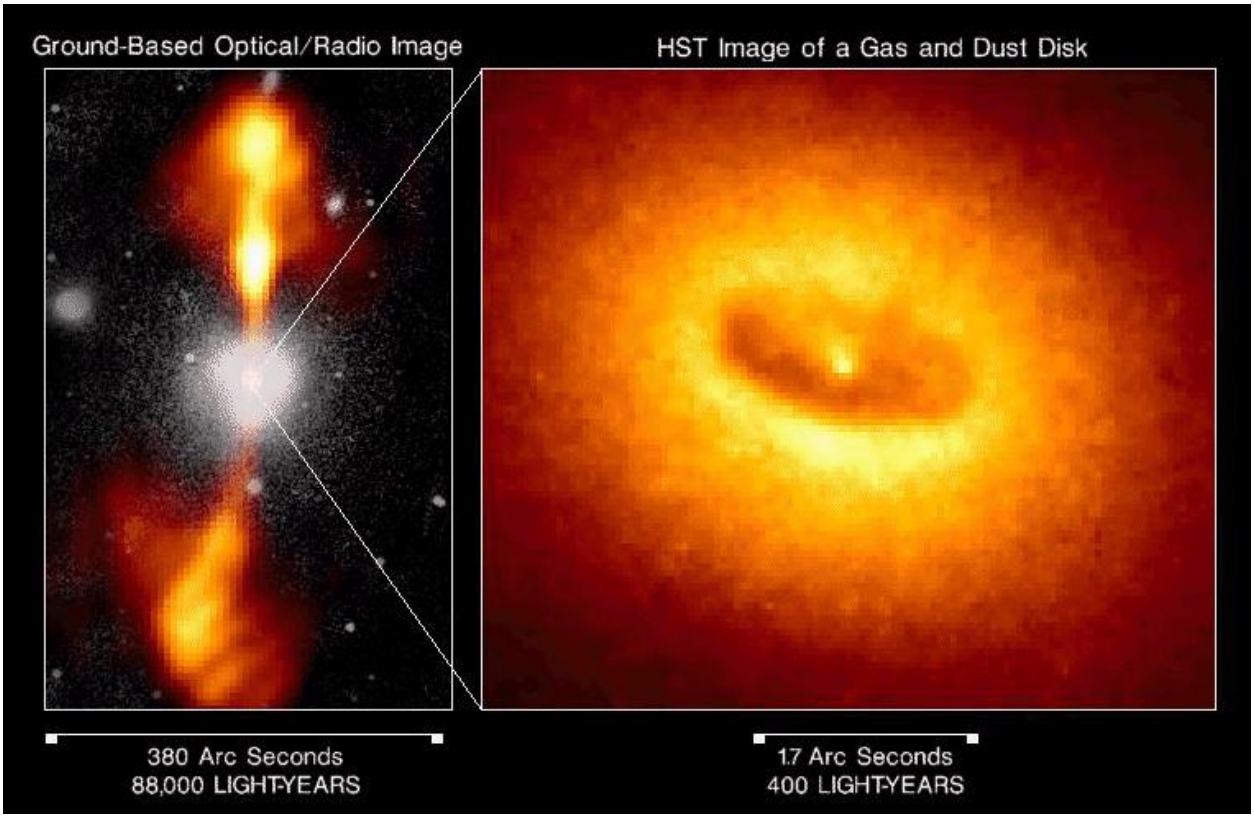
Before IceCube was completed in 2010, scientists had observed just 14 neutrinos.

With the huge new instrument, paired with another telescope in the Mediterranean, hundreds of neutrinos have been detected.

So far, all of those have been created in the Earth's atmosphere, but IceCube scientists hope to eventually detect those from space.

"Neutrinos... will point back to where they came from," Adams said.

DARK STAR IMAGING....



If there were monsters in space, they might appear as black holes - bottomless pits of gravity that rip holes in the fabric of time and space, swallowing up entire stars. Nothing - not even light - can escape.

The study of black holes began in the 1930's, when an Indian astrophysicist named Subramanian Chandrasekhar found that there is a limit to how much gravity can be supported by matter as we know it. Nothing here on Earth comes close to exceeding this matter-gravity limit, but the phenomenon often occurs in space.

Every single second, in the middle of a star, violent, uncontrolled fusion reactions occur that are millions of times more powerful than our entire nuclear arsenal. The star's massive gravitational field keeps it from exploding under the pressure. But when a star uses up its nuclear fuel, the mass and gravity continue to press down toward its center.

The central portion of a relatively small star like our Sun is then crushed into a hot, super-dense cinder as small as Earth, with maybe half the mass of the Sun. The gravity force squeezes this "white dwarf" star until each teaspoon of material weighs about as much as an 18-wheel truck,

but at that point, the crush of gravity stops. For stars somewhat larger than the Sun, the remnant core can exceed about one and one-half Suns (the Chandrasekhar limit for white dwarfs). Gravity is so strong in this case that the collapse continues until the cores are the size of a small town and each teaspoon of their matter weighs as much as one million 18-wheelers. These are the neutron stars, which we often see as pulsars.

For stars maybe 20 times or more massive than our Sun, things are very different. The remnant core will be more than three times as massive as the Sun (the Chandrasekhar limit for neutron stars), and then gravity takes complete control. Not even the fundamental structure of matter can stand up to the colossal forces. A bottomless pit forms that can suck in anything, even light. A black hole is born.

Since a black hole has no surface, astronomers define its "edge" as the point-of-no-return, where all paths through space are bent back into the black hole. This edge is called the event horizon. Any event that takes place within this limit is, in a real way, disconnected from the rest of our universe. We'll never know what goes on down there, as no information will ever find its way out. If the black hole also rotates rapidly, then its intense gravity twists the fabric of space and time into a violent, rotating tornado-like vortex.

So how can we observe a black hole, since it gives off no light? Astronomers can recognize telltale signs that a black hole is present, even if they can't see the actual beast. They can see light emitted by material just as it's falling into a black hole, and they also can observe very high velocity explosions as they are ejected from the vicinity. A good analogy is watching water spiral down a drain. You can't see down inside the drain, but you can watch the water spin around before going down. As material is swept up into this flow, huge amounts of X-rays are produced, heated to millions of degrees. If the black hole also rotates, anything close to the event horizon cannot stand still, as space itself spins around like a tornado. This violent action can spin off fast winds and jets that travel as much as one million light years away from the black hole.

Scientists have just concluded a five-year study of these "cosmic monsters." NASA has been part of Japan's Very Long Baseline Interferometry Space Observatory Program, an international mission which has simultaneously used many ground radio telescopes and one radio telescope in space. This creates a "virtual" giant telescope three times the size of the Earth, which can observe astronomical objects in much greater detail than smaller, individual telescopes. The mission has observed powerful energy jets spewing out from the vicinity of black holes that weigh more than a hundred million Suns. They found that these jets are traveling much faster than expected - at more than 99.9-percent the speed of light. The jets sometimes wiggle, which may reveal clues about what is happening to the black hole itself, including the possibility of a second black hole orbiting the one making the jet. The mission also has observed, projected on the bright jets, shadows of thin "accretion" disks of hot gas orbiting the black holes. Accretion disks supply the black holes with the fuel they need to create X-rays and jets, so these observations have allowed scientists to study the kind of diet enjoyed by the monsters.

Another proposed mission, Advanced Radio Interferometry between Space and Earth, or Arise, would use a more powerful radio telescope in space with others on Earth to learn more about black holes.

Black holes - the most powerful and exotic objects in the universe - continue to hold great fascination for scientists and the public alike. The more we learn about them, the more it will help us piece together this mysterious great cosmic puzzle.

NASA to Preview Black Hole-Hunting Telescope...

At Vandenberg Air Force Base in California, a fairing is installed on NASA's NuSTAR satellite Friday, Mar. 2, 2012 to protect the satellite as it travels through the atmosphere and into space. The satellite will be mated to Orbital Science's Pegasus rocket.

NASA will offer a sneak peak at its next spacecraft to launch, the black hole-hunting Nuclear Spectroscopic Telescope Array (NuSTAR) observatory, during a press conference Monday (June 11).

NuSTAR is due to lift off next Wednesday (June 13) at 11:30 a.m. EDT (1530 GMT) from Kwajalein Atoll in the central Pacific Ocean. The space telescope will use X-ray eyes to study how black holes form and how they grow within galaxies, affecting their evolution.

The $165 million is due to launch on an Orbital Sciences Pegasus XL rocket, which will be carried into the air by an L-1011 Stargazer aircraft. Once aloft, the plane will release the rocket, which will then fire its engines to climb the rest of the way to orbit.

The Stargazer plane left Vandenberg Air Force Base in central California on June 5, and was due to land on the atoll June 6.

The Monday briefing will take place at 3 p.m. EDT at the Space Sciences Laboratory at the University of California, Berkeley, and will feature:

- Omar Baez, NASA launch director, Kennedy Space Center, Fla.
- Fiona Harrison, NuSTAR principal investigator, California Institute of Technology, Pasadena, Calif.
- William Craig, NuSTAR instrument manager, University of California at Berkeley (UC Berkeley)
- Grace Baird, NuSTAR bus chief engineer, Orbital Sciences Corporation, Dulles, Va.

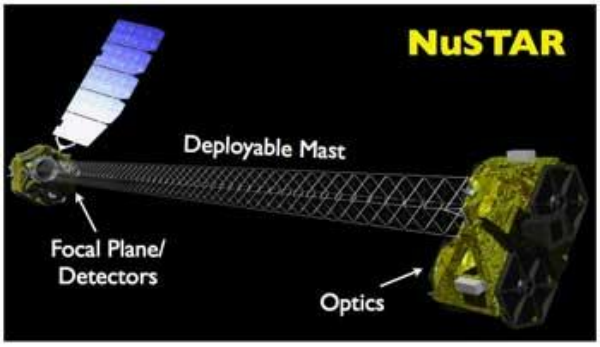
Live audio of the press conference will be broadcast at http://www.nasa.gov/newsaudio .

About NuSTAR: The Nuclear Spectroscopic Telescope Array

The NuSTAR mission will deploy the first focusing telescopes to image the sky in the high energy X-ray (6 - 79 keV) region of the electromagnetic spectrum. Our view of the universe in this spectral window has been limited because previous orbiting telescopes have not employed true focusing optics, but rather have used coded apertures that have intrinsically high backgrounds and limited sensitivity.

During a two-year primary mission phase, NuSTAR will map selected regions of the sky in order to:

1. take a census of collapsed stars and black holes of different sizes by surveying regions surrounding the center of own Milky Way Galaxy and performing deep observations of the extragalactic sky;
2. map recently-synthesized material in young supernova remnants to understand how stars explode and how elements are created; and
3. understand what powers relativistic jets of particles from the most extreme active galaxies hosting supermassive black holes.



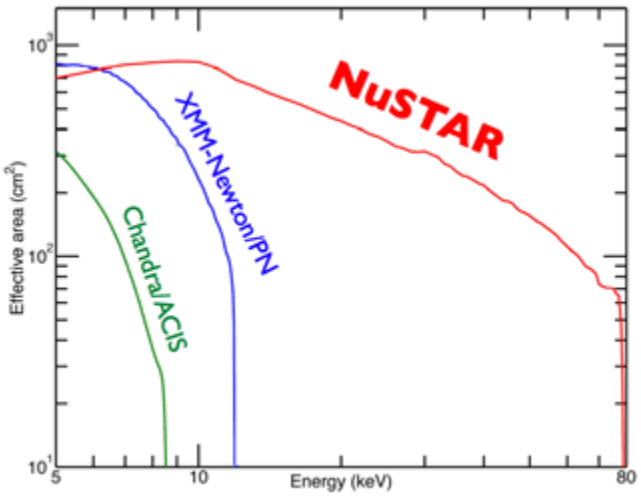
NuSTAR, fully extended after launch.

In addition to its core science program, NuSTAR will offer opportunities for a broad range of science investigations, ranging from probing cosmic ray origins to studying the extreme physics around collapsed stars to mapping microflares on the surface of the Sun. NuSTAR will also respond to targets of opportunity including supernovae and gamma-ray bursts.

The NuSTAR instrument consists of two co-aligned grazing incidence telescopes with specially coated optics and newly developed detectors that extend sensitivity to higher energies as compared to previous missions such as Chandra and XMM. After launching into orbit on a small rocket, the NuSTAR telescope extends to achieve a 10-meter focal length. The observatory will provide a combination of sensitivity, spatial, and spectral resolution factors of 10 to 100 improved over previous missions that have operated at these X-ray energies.

A NASA Small Explorer (SMEX) mission, NuSTAR launched on June 13, 2012.

For Astronomers: Fact Sheet



- **Energy Band:** 5 - 80 keV

- **Angular Resolution:** ~50" (HPD), ~10" (FWHM)
- **Field of View:** 13' x 13'
- **Energy Resolution:** 0.5 keV at 6 keV, 1.0 keV at 60 keV (FWHM)
- **Temporal Resolution:** 0.1 msec
- **Maximum Flux Measurement Rate:** 10,000 cts/s
- **ToO response:** < 48 hours
- **Launch date:** June 13, 2012
- **Orbit:** 550 km x 600 km, 6 degree inclination
- **Slew Rate:** 0.02 deg / sec
- **Settle Time:** 142 sec

The above NuSTAR parameters are the current best estimate (CBE) values, as of November 2011. Values will be updated with in-flight measured values after launch.

...Chandra X-Ray Telescope...

- Since its launch on July 23, 1999, the Chandra X-ray Observatory has been NASA's flagship mission for X-ray astronomy, taking its place in the fleet of "Great Observatories."

- **Who we are**

NASA's Chandra X-ray Observatory is a telescope specially designed to detect X-ray emission from very hot regions of the Universe such as exploded stars, clusters of galaxies, and matter around black holes. Because X-rays are absorbed by Earth's atmosphere, Chandra must orbit

above it, up to an altitude of 139,000 km (86,500 mi) in space. The Smithsonian's Astrophysical Observatory in Cambridge, MA, hosts the Chandra X-ray Center which operates the satellite, processes the data, and distributes it to scientists around the world for analysis. The Center maintains an extensive public web site about the science results and an education program.

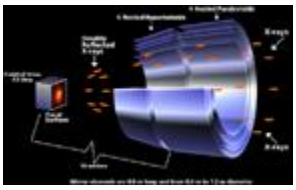
- **What we do**

Chandra carries four very sensitive mirrors nested inside each other. The energetic X-rays strike the insides of the hollow shells and are focussed onto electronic detectors at the end of the 9.2- m (30-ft.) optical bench. Depending on which detector is used, very detailed images or spectra of the cosmic source can be made and analyzed.

- **What we are excited about**

Chandra has imaged the spectacular, glowing remains of exploded stars, and taken spectra showing the dispersal of elements. Chandra has observed the region around the supermassive black hole in the center of our Milky Way, and found black holes across the Universe. Chandra has traced the separation of dark matter from normal matter in the collision of galaxies in a cluster and is contributing to both dark matter and dark energy studies. As its mission continues, Chandra will continue to discover startling new science about our high-energy Universe.

Telescope System



Mirror Comparison Movie

The Chandra telescope system consists of four pairs of mirrors and their support structure.

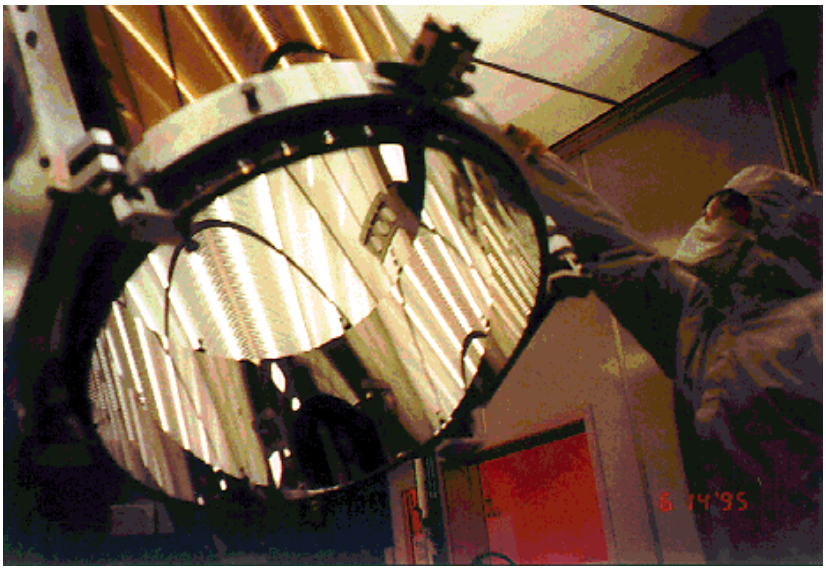
X-ray telescopes must be very different from optical telescopes. Because of their high-energy, X-ray photons penetrate into a mirror in much the same way that bullets slam into a wall. Likewise, just as bullets ricochet when they hit a wall at a grazing angle, so too will X-rays ricochet off mirrors.

The mirrors have to be exquisitely shaped and aligned nearly parallel to incoming X-rays. Thus they look more like glass barrels than the familiar dish shape of optical telescopes.

Imagine making the surface of the Earth so smooth that the highest mountain was less than two meters (78 inches) tall! On a much smaller scale, the scientists and engineers at Raytheon Optical

Systems in Danbury, Connecticut accomplished an equivalent feat when they polished and ground the four pairs of Chandra mirrors to the smoothness of a few atoms.

Not to be outdone, the scientists and engineers at Optical Coating Laboratories, Inc., in Santa Rosa, California also surpassed expectations. After the mirrors were carefully moved to California via an air-ride moving van, they were painstakingly cleaned--to the equivalent of at most one speck of dust on an area the size of your computer screen. Then they were coated with the highly reflective rare metal, iridium.



Coating the mirrors at Optical Coating Laboratories, Inc.

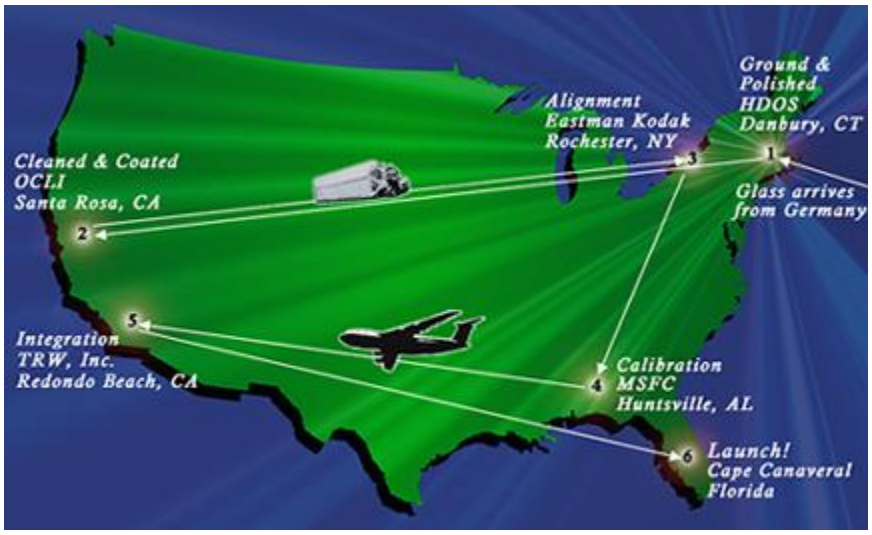
The successful grinding, polishing and coating of the Chandra mirrors were historic technical accomplishments. They are the smoothest and cleanest mirrors ever made.

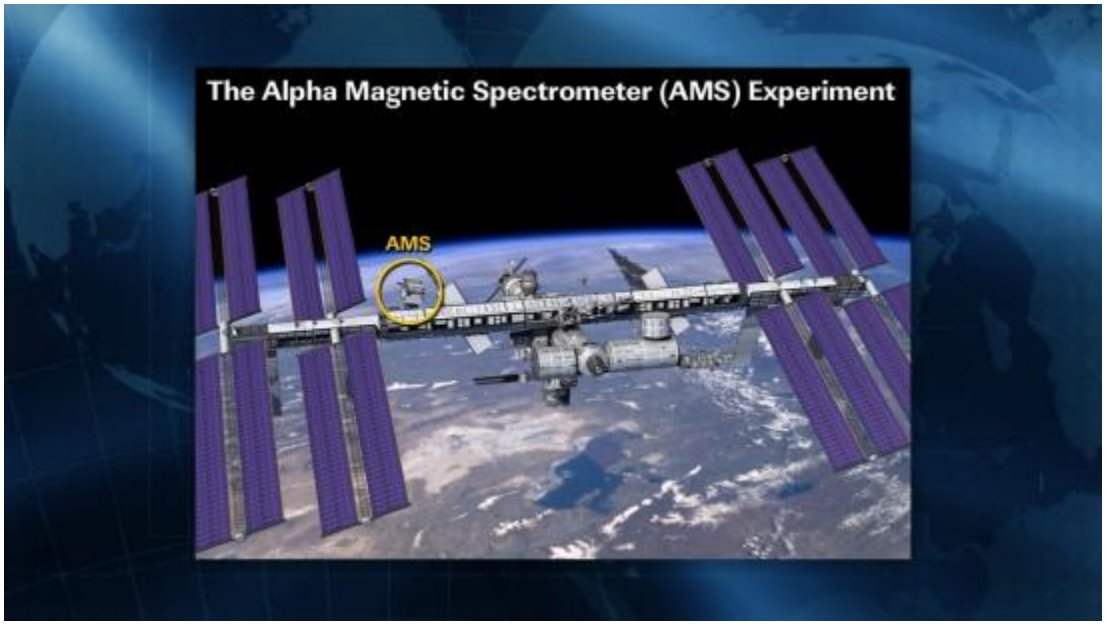
The mirrors were moved again across the country--same moving van, same husband/wife driving team and three support vehicles--to Eastman Kodak Company in Rochester, New York, where they were assembled into a support structure called the high resolution mirror assembly and aligned with exquisite precision. The alignment of the mirrors from one end of the mirror assembly to the other (2.7 meters or 9 feet) is accurate to 1.3 micrometers (50 millionths of an inch) or about one fiftieth the width of a human hair! The successful completion of the high resolution mirror assembly at Eastman Kodak in September 1996, was one of the major accomplishments in the development of Chandra.

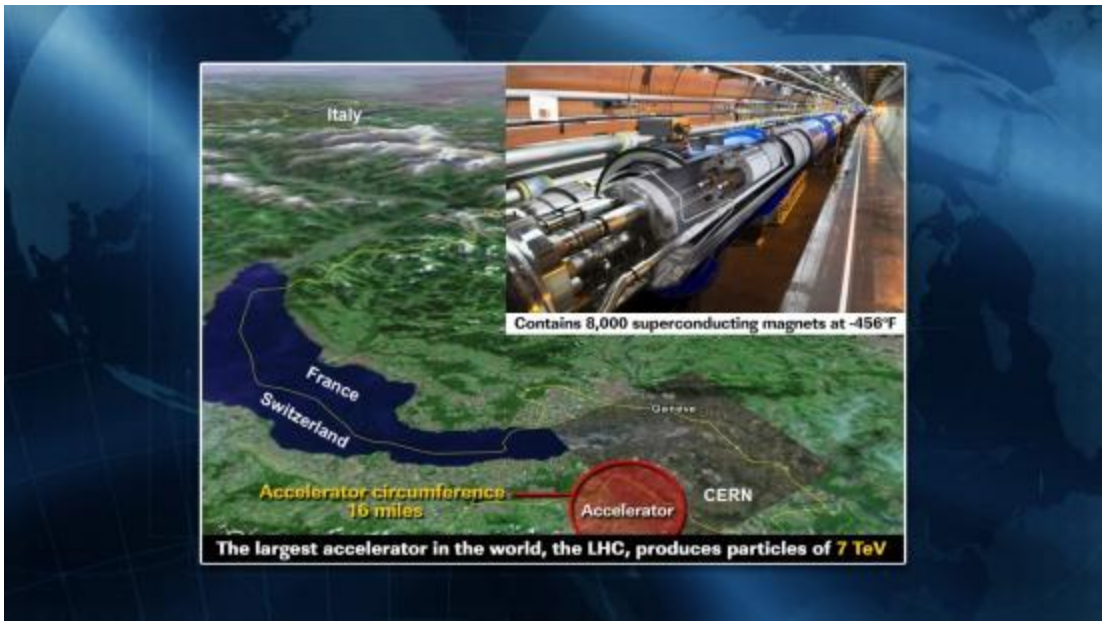
In November of 1996, the telescope system was put aboard a C5 military transport aircraft, flown to Huntsville, Alabama, and delivered to the Marshall Space Flight Center. There the telescope system and the scientific instruments were put through thousands of individual tests in an X-ray calibration facility especially constructed for this purpose by the Chandra support team at Marshall Space Flight Center. The tests, which were completed in May of 1997, showed that

Chandra could produce X-ray images 25 times sharper than previous X-ray telescopes. The telescope's resolution is equivalent to being able to read the text of a newspaper from half a mile away.

After the telescope was calibrated, it was flown to TRW (now NGST) in Redondo Beach, California. There the telescope system, instruments, and spacecraft were put together and tested for space-worthiness. Finally, in 1999 the whole observatory was flown to Cape Canaveral and placed on the space shuttle for its last ride, into space.







···Very Large Telescope···

Very Large Telescope

The four Unit Telescopes that form the VLT together with the Auxiliary Telescopes

Organization	European Southern Observatory (ESO)
Location	Paranal Observatory, Atacama desert, Chile
Coordinates	24°37′38″S 70°24′15″W
Altitude	2,635 m

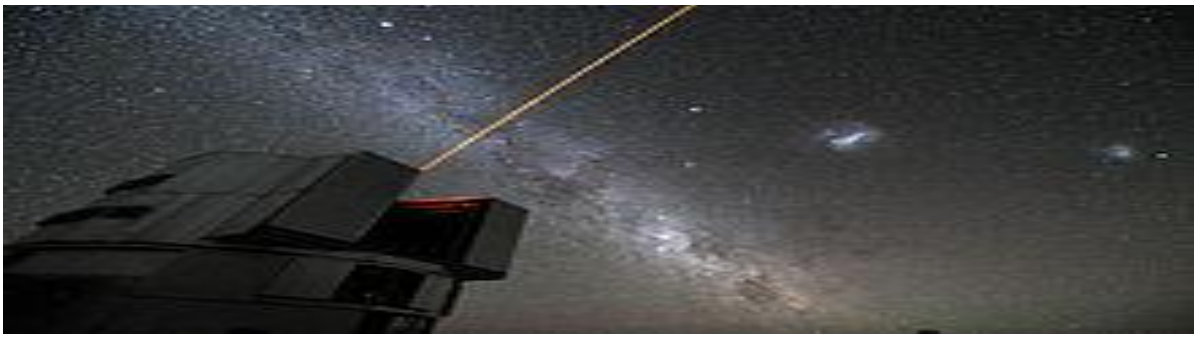
Weather	>340 clear nights/year
Wavelength	300 nm – 20 μm (visible, near- and mid-infrared)
First light	1998 (for the first Unit Telescope)
Telescope style	Ritchey-Chrétien
Diameter	4 x 8.2-metre Unit Telescopes (UT), plus 4 x 1.8-metre moveable Auxiliary Telescopes (AT)
Mounting	Altazimuth
Website	Very Large Telescope

The **Very Large Telescope** (**VLT**) is a telescope operated by the European Southern Observatory on Cerro Paranal in the Atacama Desert of northern Chile. The VLT consists of four individual telescopes, each with a primary mirror 8.2m across, which are generally used separately but can be used together to achieve very high spatial resolution.[1] The four separate optical telescopes are known as *Antu*, *Kueyen*, *Melipal* and *Yepun*, which are all words for astronomical objects in the Mapuche language. The telescopes form an array which is complemented by four movable Auxiliary Telescopes (ATs) of 1.8 m aperture.

The VLT operates at visible and infrared wavelengths. Each individual telescope can detect objects roughly four billion times fainter than what can be detected with the naked eye, and when all the telescopes are combined, the facility can achieve an angular resolution of about 0.001 arc-second. This is equivalent to roughly two metres at the distance of the Moon.[1]

The VLT is the most productive ground-based facility for astronomy, with only the Hubble Space Telescope generating more scientific papers among facilities operating at visible wavelengths.[2] Among the pioneering observations carried out using the VLT are the first direct image of an exoplanet, the tracking of individual stars moving around the supermassive black hole at the centre of the Milky Way, and observations of the afterglow of the furthest known gamma-ray burst.[3]

General information



A laser that is used for adaptive optics (excites sodium atoms in atmosphere and creates an artificial star)

The VLT consists of an arrangement of four large (8.2 meter diameter) telescopes (called Unit Telescopes or UTs) with optical elements that can combine them into an astronomical interferometer (VLTI), which is used to resolve small objects. The interferometer also includes a set of four 1.8 meter diameter movable telescopes dedicated to interferometric observations. The first of the UTs started operating in May 1998 and was offered to the astronomical community on 1 April 1999. The other telescopes followed suit in 1999 and 2000, thus making the VLT fully operational. Four 1.8-metre Auxiliary Telescopes (ATs) have been added to the VLTI to make it available when the UTs are being used for other projects. These ATs were installed between 2004 and 2007. Today, all four Unit Telescopes and all four Auxiliary Telescopes are operational.[1]

The VLT's 8.2-meter telescopes were originally designed to operate in three modes:[4]

- as a set of four independent telescopes (this is the primary mode of operation).
- as a single large coherent interferometric instrument (the **VLT Interferometer** or **VLTI**), for extra resolution. This mode is occasionally used, only for observations of relatively bright sources with small angular extent.
- as a single large incoherent instrument, for extra light-gathering capacity. The instrumentation required to bring the light to a combined incoherent focus was not built. Recently, new instrumentation proposals have been put forward for making this observing mode available.[5] Multiple telescopes are sometimes independently pointed at the same object, either to increase the total light-gathering power, or to provide simultaneous observations with complementary instruments.

Unit Telescopes

Moonset over ESO's Very Large Telescope

The UTs are equipped with a large set of instruments permitting observations to be performed from the near-ultraviolet to the mid-infrared (i.e. a large fraction of the light wavelengths accessible from the surface of the Earth), with the full range of techniques including high-resolution spectroscopy, multi-object spectroscopy, imaging, and high-resolution imaging. In particular, the VLT has several adaptive optics systems, which correct for the effects of atmospheric turbulence, providing images almost as sharp as if the telescope were in space. In the near-infrared, the adaptive optics images of the VLT are up to three times sharper than those of the Hubble Space Telescope, and the spectroscopic resolution is many times better than Hubble. The VLTs are noted for their high level of observing efficiency and automation.

The 8.2m-diameter telescopes are housed in compact, thermally controlled buildings, which rotate synchronously with the telescopes. This design minimises any adverse effects on the observing conditions, for instance from air turbulence in the telescope tube, which might otherwise occur due to variations in the temperature and wind flow.[3]

Preparations for the new Adaptive Optics Facility in UT4.[6]

The principal role of the main VLT telescopes is to operate as four independent telescopes. The interferometry (combining light from multiple telescopes) is used about 20 percent of the time for very high-resolution on bright objects, for example, on Betelgeuse. This mode allows astronomers to see details up to 25 times finer than with the individual telescopes. The light beams are combined in the VLTI using a complex system of mirrors in underground tunnels

where the light paths must be kept equal to distances less than 1/1000 mm over a hundred metres. With this kind of precision the VLTI can reconstruct images with an angular resolution of milliarcseconds.[1]

Mapuche names for the Unit Telescopes

Interior of one 8.2 m Unit Telescope 1 (UT1) named Antu

It had long been ESO's intention to provide "real" names to the four VLT Unit Telescopes, to replace the original technical designations of UT1 to UT4. In March 1999, at the time of the Paranal inauguration, four meaningful names of objects in the sky in the Mapuche language were chosen. This indigenous people lives mostly south of Santiago de Chile.

An essay contest was arranged in this connection among schoolchildren of the Chilean II Region of which Antofagasta is the capital to write about the implications of these names. It drew many entries dealing with the cultural heritage of ESO's host country.

The winning essay was submitted by 17-year old Jorssy Albanez Castilla from Chuquicamata near the city of Calama. She received the prize, an amateur telescope, during the inauguration of the Paranal site.[7]

Unit Telescopes 1-4 are now known as Antu (Sun), Kueyen (Moon), Melipal (Southern Cross), and Yepun (Venus as evening star) respectively.[8] Originally translated as "Sirius", it now seems that "Yepun" actually means "Venus".[9]

Auxiliary Telescopes

The Four ATs at Paranal. The Unit Telescopes are seen in the background.

Although the four 8.2-metre Unit Telescopes can be combined in the VLTI, they are mostly used for individual observations and are only available for interferometric observations for a limited number of nights every year. But the four smaller 1.8-metre ATs are available and dedicated to interferometry to allow the VLTI to operate every night.[3]

The top part of each AT is a round enclosure, made from two sets of three segments, which open and close. Its job is to protect the delicate 1.8-metre telescope from the desert conditions. The enclosure is supported by the boxy transporter section, which also contains electronics cabinets, liquid cooling systems, air-conditioning units, power supplies, and more. During astronomical observations the enclosure and transporter are mechanically isolated from the telescope, to ensure that no vibrations compromise the data collected.[1]

The transporter section runs on tracks, so the ATs can be moved to 30 different observing locations. As the VLTI acts rather like a single telescope as large as the group of telescopes combined, changing the positions of the ATs means that the VLTI can be adjusted according to the needs of the observing project.[1] The reconfigurable nature of the VLTI is similar to that of the Very Large Array.

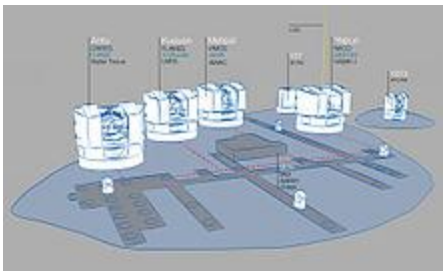
Science with the VLT

Results from the VLT have led to the publication of an average of more than one peer-reviewed scientific paper per day. For instance in 2007, almost 500 refereed scientific papers were published based on VLT data.[10] The telescope's scientific discoveries include imaging an extrasolar planet for the first time,[11] tracking individual stars moving around the supermassive black hole at the centre of the Milky Way,[12] and observing the afterglow of the furthest known gamma-ray burst.[13]

Other discoveries with VLT's signature include the detection of carbon monoxide molecules in a galaxy located almost 11 billion light-years away for the first time, a feat that had remained elusive for 25 years. This has allowed astronomers to obtain the most precise measurement of the cosmic temperature at such a remote epoch.[14] Another important study was that of the violent flares from the supermassive black hole at the centre of the Milky Way. The VLT and APEX teamed up to reveal material being stretched out as it orbits in the intense gravity close to the central black hole.[15]

Using the VLT, astronomers have also measured the age of the oldest star known in our galaxy, the Milky Way. At 13.2 billion years old, the star was born in the earliest era of star formation in the Universe.[16] They have also analysed the atmosphere around a super-Earth exoplanet for the first time using the VLT. The planet, which is known as GJ 1214b, was studied as it passed in front of its parent star and some of the starlight passed through the planet’s atmosphere.[17]

In all, of the top 10 discoveries done at ESO's observatories, seven have VLT's signature.[18]



A diagram showing instruments at VLT

Technical details

Instruments

The VLT instrumentation programme is the most ambitious programme ever conceived for a single observatory. It includes large-field imagers, adaptive optics corrected cameras and spectrographs, as well as high-resolution and multi-object spectrographs and covers a broad spectral region, from deep ultraviolet (300 nm) to mid-infrared (24 µm) wavelengths.[1]

Instruments on the VLT[19][20]

Telescope	Cassegrain-Focus	Nasmyth-Focus A	Nasmyth-Focus B
Antu (UT1)	FORS 2	*CRIRES*	Guest focus
Kueyen (UT2)	X-Shooter	FLAMES	UVES
Melipal (UT3)	VISIR	ISAAC	VIMOS
Yepun (UT4)	SINFONI	*HAWK-I*	NACO

VLT's Next-generation Laser Launch Telescope.

- **FORS 1** (FOcal Reducer and low dispersion Spectrograph) is a visible light camera and Multi Object Spectrograph with a 6.8 arcminute field of view.
- **FORS 2**. Like FORS 1, but with further multi-object spectroscopy.
- **ISAAC** (Infrared Spectrometer And Array Camera) is a near infrared imager and spectrograph
- **UVES** (Ultraviolet and Visual Echelle Spectrograph) is an ultraviolet and visible light spectrograph.
- **FLAMES** (Fibre Large Array Multi-Element Spectrograph) is a multi-object fibre feed unit for UVES and GIRAFFE, the latter allowing the capability for simultaneously studying hundreds of individual stars in nearby galaxies at moderate spectral resolution in the visible.
- **NACO** (NAOS-CONICA, NAOS meaning Nasmyth Adaptive Optics System and CONICA meaning COude Near Infrared CAmera) is an adaptive optics facility which produces infrared images as sharp as if taken in space and includes spectroscopic, polarimetric and coronagraphic capabilities.
- **VISIR** (VLT spectrometer and imager for the mid-infrared) provides diffraction-limited imaging and spectroscopy at a range of resolutions in the 10 and 20 micrometre mid-infrared (MIR) atmospheric windows.
- **SINFONI** (Spectrograph for INtegral Field Observations in the Near Infrared) is a medium resolution, near-infrared (1-2.5 micrometres) integral field spectrograph fed by an adaptive optics module.
- **CRIRES** (CRyogenic InfraRed Echelle Spectrograph) is adaptive optics assisted and provides a resolving power of up to 100,000 in the infrared spectral range from 1 to 5 micrometres.
- **HAWK-I** (High Acuity Wide field K-band Imager) is a near-infrared imager with a relatively large field of view.
- **VIMOS** (VIsible Multi-Object Spectrograph) delivers visible images and spectra of up to 1,000 galaxies at a time in a 14 x 14 arcmin field of view.
- **X-Shooter**, the first second-generation instrument, a wide-band [UV to near infrared] spectrometer designed to explore the properties of rare, unusual or unidentified sources
- **PIONIER**, an instrument to combine the light of all 8-metre telescopes, allowing to pick up details about 16 times finer than can be seen with one UT.[21]
- **PRIMA** (Phase Referenced Imaging and Microarcsecond Astrometry), the VLTI instrument for astronomical interferometry using either the ATs or the UTs. Its astrometric capability and its faint source capabilities will allow astronomers to reach past the barrier of sensitivity that has plagued interferometers and examine faint targets with high angular resolution.[22]
- Guest focus available for visitor instruments, such as ULTRACAM or DAZZLE.

Several second-generation VLT instruments are now under development:

- **KMOS**, a cryogenic infrared multi-object spectrometer intended primarily for the study of distant galaxies.[23]

- **MUSE**, a huge "3-dimensional" spectroscopic explorer which will provide complete visible spectra of all objects contained in "pencil beams" through the Universe.[24]
- **SPHERE**, a high-contrast adaptive optics system dedicated to the discovery and study of exoplanets.[25]
- **SAXO** (SPHERE extreme AO system), an instrument that combines an extreme adaptive optics system, various coronagraphic devices and a suite of focal instruments providing imaging, integral field spectroscopy and polarimetry capabilities in the visible and near-infrared spectral ranges.[26]
- **ESPRESSO** (Echelle Spectrograph for Rocky Exoplanet- and Stable Spectroscopic Observations), a high-resolution, fiber-fed and cross-dispersed echelle spectrograph for the visible wavelength range, capable of operating in 1-UT mode and in 4-UT mode, for the search for rocky extra-solar planets in the habitable zone of their host stars.[27]

Interferometry and the VLTI

In its interferometric operating mode, the light from the telescopes is reflected off mirrors and directed through tunnels to a central beam combining laboratory. The VLTI is intended to achieve an effective angular resolution of 0.002 arcsecond at a wavelength of 2 μm. This is comparable to the resolution achieved using other arrays such as the Navy Prototype Optical Interferometer and the CHARA array. Unlike many earlier optical and infrared interferometers, the AMBER instrument on VLTI was initially designed to perform coherent integration (which requires signal-to-noise greater than one in each atmospheric coherence time). Using the big telescopes and coherent integration, the faintest object the VLTI can observe is magnitude 7 in the near infrared for broadband observations,[28] similar to many other near infrared / optical interferometers without fringe tracking[2]. In 2011, an incoherent integration mode was introduced [29] called AMBER "blind mode" which is more similar to the observation mode used at earlier interferometer arrays such as COAST, IOTA and CHARA. In this "blind mode", AMBER can observe sources as faint as K=10 in medium spectral resolution. At more challenging mid-infrared wavelengths, the VLTI can reach magnitude 4.5, significantly fainter than the Infrared Spatial Interferometer. When fringe tracking is introduced, the limiting magnitude of the VLTI is expected to improve by a factor of almost 1000, reaching a magnitude of about 14. This is similar to what is expected for other fringe tracking interferometers. In spectroscopic mode, the VLTI can currently reach a magnitude of 1.5. The VLTI can work in a fully integrated way, so that interferometric observations are actually quite simple to prepare and execute. The VLTI has become worldwide the first general user optical/infrared interferometric facility offered with this kind of service to the astronomical community.[30]

Because of the many mirrors involved in the optical train, about 95 percent of the light is lost before reaching the instruments at a wavelength of 1 µm, 90 percent at 2 µm and 75 percent at 10 µm.[31] This refers to reflection off 32 surfaces including the Coudé train, the star separator, the main delay line, beam compressor and feeding optics. Additionally, the interferometric technique is such that it is very efficient only for objects that are small enough that all their light is concentrated. For instance, an object with a relatively low surface brightness such as the moon cannot be observed, because its light is too diluted. Only targets which are at temperatures of more than 1,000°C have a surface brightness high enough to be observed in the mid-infrared, and objects must be at several thousands of degrees Celsius for near-infrared observations using the VLTI. This includes most of the stars in the solar neighborhood and many extragalactic objects such as bright active galactic nuclei, but this sensitivity limit rules out interferometric observations of most solar-system objects. Although the use of large telescope diameters and adaptive optics correction can improve the sensitivity, this cannot extend the reach of optical interferometry beyond nearby stars and the brightest active galactic nuclei.

Because the Unit Telescopes are used most of the time independently, they are used in the interferometric mode mostly during bright time (that is, close to Full Moon). At other times, interferometry is done using 1.8 meter Auxiliary Telescopes (ATs), which are dedicated to full-time interferometric measurements. The first observations using a pair of ATs were conducted in February 2005, and all the four ATs have now been commissioned. For interferometric observations on the brightest objects, there is little benefit in using 8 meter telescopes rather than 1.8 meter telescopes.

The first two instruments at the VLTI were VINCI (a test instrument used to set-up the system, now decommissioned) and MIDI,[32] which only allow two telescopes to be used at any one time. With the installation of the three-telescope AMBER closure-phase instrument in 2005, the first imaging observations from the VLTI are expected soon. Deployment of The Phase Referenced Imaging and Microarcsecond Astrometry (PRIMA) instrument started 2008 with the aim to allow phase-referenced measurements in either an astrometric two-beam mode or as a fringe-tracker successor to VINCI, operated concurrent with one of the other instruments.[33][34][35]

After falling drastically behind schedule and failing to meet some specifications, in December 2004 the VLT Interferometer became the target of a second ESO "recovery plan". This involves additional effort concentrated on improvements to fringe tracking and the performance of the main delay lines. Note that this only applies to the interferometer and not other instruments on Paranal. In 2005, the VLTI was routinely producing observations, although with a brighter limiting magnitude and poorer observing efficiency than expected.

As of March 2008, the VLTI had already led to the publication of 89 peer-reviewed publications[36][37][38] and had published a first-ever image of the inner structure of the mysterious Eta Carinae.[39] In March 2011, the PIONIER instrument for the first time simultaneously combined the light of the four Unit Telescopes, potentially making VLTI the biggest optical telescope in the world.[21] However, this attempt was not really a success.[40] The first successful attempt was in February 2012, with four telescopes combined into a 130 meter diameter mirror.[40]

In popular culture

One of the large mirrors of the telescopes was the subject of an episode of the National Geographic Channel's reality series *World's Toughest Fixes*, where a crew of engineers removed and transported the mirror to be cleaned and re-coated with aluminium. The job required battling strong winds, fixing a broken pump in a giant washing machine and resolving a rigging issue.

The area surrounding the Very Large Telescope has also been featured in a blockbuster movie. The VLT Hotel, the Residencia, is an award-winning building, and served as a backdrop for part of the James Bond movie *Quantum of Solace*.[3] The movie producer, Michael G. Wilson, said: "The Residencia of Paranal Observatory caught the attention of our director, Marc Forster and production designer, Dennis Gassner, both for its exceptional design and its remote location in the Atacama desert. It is a true oasis and the perfect hide out for Dominic Greene, our villain, whom 007 is tracking in our new James Bond film."[41]

...South African Astronomical Observatory...

South African Astronomical Observatory

The Southern African Large Telescope

Organization	National Research Foundation of South Africa
Code	51, B31, A60

Location	Headquarters in Observatory, Cape Town Major telescopes in Sutherland, Northern Cape
Coordinates	Headquarters: 33.9347°S 18.4776°ECoordinates: 33.9347°S 18.4776°E Sutherland: 32.3783°S 20.8105°E
Established	January 1972
Website	http://www.saao.ac.za

Telescopes

SALT	11m reflector
Radcliffe	1.9m reflector
Infrared Survey Facility	1.4m reflector
MONET	1.2m reflector
Elizabeth	1m reflector
SuperWASP-South	8x Canon 200mm f/1.8
ACT	75cm reflector
Solaris-1	0.5m f/15 Ritchey–Chrétien
Solaris-1	0.5m f/15 Ritchey–Chrétien

South African Astronomical Observatory (*SAAO*) is the national center for optical and infrared astronomy in South Africa. It was established in 1972. The observatory is run by the National Research Foundation of South Africa. The facility's function is to conduct research in astronomy and astrophysics. The primary telescopes are located in Sutherland, which is 370 kilometres (230 mi) from Observatory, Cape Town, which is where the headquarters is located. [1]

The **SAAO** has international links worldwide that exchange scientific and technological collaboration. Contributions from the South African Astronomical Observatory to the science field include the development of a spherical aberration corrector and the *Southern African Large Telescope*, otherwise known as **SALT**.

The Noon Gun on Cape Town's Signal Hill is fired remotely by a time signal from the Observatory.

History

The buildings of the South African Astronomical Observatory in Cape Town.

The history of the SAAO began when the Royal Observatory at the Cape of Good Hope was founded in 1820, the first scientific institution in Africa.[2] Construction of the main buildings were completed in 1829 at a cost of £30,000[3] (equivalent to £2.2 million in 2012[4]). The post of *Her Majesty's astronomer at the Cape of Good Hope* was awarded the Royal Medal on two occasions; the first to Thomas Maclear in 1869 for measurement of an arc of the meridian at the Cape of Good Hope[5] and the second to David Gill in 1903 for researches in solar and stellar parallax, and his energetic direction of the Royal Observatory at the Cape of Good Hope.[6]

During the 1970s, the Republic Observatory in Johannesburg and the Radcliffe Observatory in Pretoria merged with the much older Royal Observatory to form the South African Astronomical Observatory.

SAAO was established in January 1972 as a result of a joint agreement by the Council for Scientific and Industrial Research (CSIR) of South Africa and Science and Engineering Research Council (SERC) of United Kingdom. The headquarters are located on the grounds of the old Royal Observatory where the main building, offices, national library for astronomy and computer facilities are housed. Historic telescopes are also found at the headquarters in a number of domes and a small museum that displays scientific instruments. The South African Astronomical Observatory is administered as a National Facility under management of the National Research Foundation (NRF), now formerly Foundation for Research Development (FRD). In 1974, when the Radcliffe Observatory in Pretoria closed, the Royal Observatory and the Republic Observatory combined facilities. The Council for Scientific and Industrial Research (CSIR) purchased the 1.9 Radcliffe telescope and transported it to Sutherland.[7]

Facilities

The observatory operates from the ground of the *Royal Observatory, Cape of Good Hope* that was established in 1820[8] in the suburb of Observatory, Cape Town.

The major observing facilities are however located near the town of Sutherland some 370 kilometres (230 mi)[1] from Cape Town.

Telescopes (Cape Town)

McClean telescope buildings

McClean telescope

Also known as the *Victoria telescope*, this telescope is fitted with a 24 inches (61 cm) photographic objective and a 18 inches (46 cm) visual objective.[9][10] The telescope was built by Grubb and completed in 1897. It was officially opened on 10 September 1901 by Sir Walter Hely-Hutchinson.[10]

Phased Experimental Demonstrator (PED)

The PED was built by members of the Karoo Array Telescope team in order to gain experience in the construction of interferometric telescopes. It is located on the grounds of the SAAO Headoffice in Observatory, Cape Town and consists of six 2.5 metres (8.2 ft) and one 3.4 metres (11 ft) antennas suitable for work at 1.4 GHz.[11]

Telescopes (Sutherland)

The 0.5-m telescope at Sutherland

0.50m telescope

This 0.5 metres (20 in) reflector was originally built for the Republic Observatory in 1967, but was moved to the Sutherland site in 1972.

0.75m telescope

A 0.75 metres (30 in) Grubb Parsons reflector.

Alan Cousins Telescope (ACT)

This 29.5 inches (75 cm) telescope was originally called the Automatic Photometric Telescope, but has been renamed the Alan Cousins Telescope in honour of Alan William James Cousins.[12][13]

BiSON

Main article: Birmingham Solar Oscillations Network

One of six telescopes in the Birmingham Solar Oscillations Network

Elizabeth Telescope

See also: Probing Lensing Anomalies Network

This 40 inches (1.0 m) telescope was originally located at SAAO Headoffice in Observatory, Cape Town, but has since moved to the Sutherland site.[14] This telescope participates in the PLANET network.[15]

Infrared Survey Facility (IRSF)

The IRSF is a 140 centimetres (55 in) reflector fitted with a 3 colour Infrared Imager.[16] Originally built as part of the *Magellanic Clouds - A Thorough Study* grant from the Japanese Ministry of Education, Culture, Sports, Science and Technology in 2000.[17] Other studies the telescope participated in include:

- The Indian Department of Space used this telescope for the *Near Infrared Survey of the Nuclear Regions of the Milky Way* in order to improve on data from the DENIS and 2MASS Astronomical surveys.[18]

MONET

One of the two 1.20 metres (47 in) telescopes of the MOnitoring NEtwork of Telescopes Project is located at Sutherland, its twin can be found at the McDonald Observatory in Texas.[19] The MONET telescopes are Robotic telescope controllable via the Internet and was constructed by the University of Göttingen.[20] Remote Telescope Markup Language is used to control the telescopes remotely.[21]

Radcliffe Telescope

Not to be confused with the Radcliffe 18/24-inch Double Refractor at the University of London Observatory.

The 1.9 metres (75 in) Radcliffe Telescope was commissioned for the Radcliffe Observatory in Pretoria and was operated between 1948 and 1972. In 1972 it was moved to Sutherland. Between 1951 and 2004 it was the largest telescope in South Africa.[22]

Project Solaris

Two telescopes forming part of Project Solaris is located at the Sutherland site. Solaris-1 and Solaris-2 are both 0.5m f/15 Ritchey–Chrétien telescope. The aims of Project Solaris is to detect circumbinary planets around eclipsing binary stars and to characterise these binaries to improve stellar models.[23]

SALT

Southern African Large Telescope (SALT)

Main article: Southern African Large Telescope

Observatory Code: B31
Observations: (Near Earth Objects)

SALT was inaugurated in November 2005. It is the largest single optical telescope in the Southern Hemisphere, with a hexagonal mirror array 11 meters across. SALT shares similarities with the Hobby-Eberly Telescope (HET) in Texas. The Southern African Large Telescope gathers twenty-five times as much light as any other existing African Telescope.[24] With this larger mirror array, SALT can record distant stars, galaxies and quasars.

SuperWASP-South

SuperWASP-South

Main article: SuperWASP
See also: List of extrasolar planets

The **Wide Angle Search for Planets** consists of two robotic telescopes, the one located at SAAO Sutherland and the other at Roque de los Muchachos Observatory on the island of La Palma in the Canaries.[25] WASP-17b, the first exoplanet known to have a retrograde orbit was discovered in 2009 using this array.

KELT-South

KELT-South (*Kilodegree Extremely Little Telescope - South*) is a small robotic telescope that is designed to detect transiting extrasolar planets. The telescope is owned and operated by Vanderbilt University and was based on the design of KELT-North, which was conceived and designed at the Ohio State University, Department of Astronomy. The KELT-South telescope will serve as a counterpart to its northern twin, surveying the southern sky for transiting planets over the next few years.

Yonsei Survey Telescopes for Astronomical Research (YSTAR)

> *Observatory Code: A60*
> *Observations: (Near Earth Objects)*

Used for the monitoring of variable stars and other transient events. This telescope is a joint project between SAAO and the Yonsei University, Korea.[20]

Geophysical

South African Geodynamic Observatory Sutherland (SAGOS)

The GeoForschungsZentrum, Potsdam in cooperation with the National Research Foundation of South Africa constructed the SAGOS between 1998 and 2000. SAGOS consist of a 1 Hz

permanent GPS station, a superconducting gravimeter, meteorological sensors, and a tri-axial magnetometer. The GPS station is also used in support of the CHAllenging Minisatellite Payload (*CHAMP*) and Gravity Recovery and Climate Experiment (*GRACE*) space missions.[26]

SUR Station

The SUR station forms part of the International Deployment of Accelerometers Project and the Global Seismographic Network of the Incorporated Research Institutions for Seismology[27][28]

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See also

- National Research Foundation of South Africa
- Astronomical Society of Southern Africa
- Other optical observatories and telescopes in South Africa
  - Boyden Observatory
  - Union Observatory
  - Natal Observatory
- Radio observatories and telescopes in South Africa
  - Hartebeesthoek Radio Astronomy Observatory
  - MeerKAT
- Magnetic observatories in South Africa
  - Hermanus Magnetic Observatory

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SOUTH AFRICAN SQUARE KILOMETER ARRAY

MeerKAT

Organization	NRF Department of Science and Technology[1] SKA South Africa Project
Location	Northern Cape, South Africa
Coordinates	30.721°S 21.411°ECoordinates: 30.721°S 21.411°E
Wavelength	radio 3 centimetres (1.2 in) to 30 centimetres (12 in)
Built	Under construction
Telescope style	Radio interferometer
Collecting area	~18,000 square metres (190,000 sq ft) with 2,000 square metres (22,000 sq ft) built at July 2012
Website	http://www.ska.ac.za/meerkat/index.php

MeerKAT is a radio telescope under construction in the Northern Cape of South Africa. It will be the largest and most sensitive radio telescope in the southern hemisphere until the Square Kilometer Array is completed around 2024.[1] The telescope will be used for research into cosmic magnetism, galactic evolution, the large-scale structure of the cosmos, dark matter and the nature of transient radio sources.[1] It will also serve as a technology demonstrator for South Africa's bid to host the Square Kilometer Array.[2] The KAT-7 engineering test bed of seven dishes is already complete on site. The construction and commissioning of the full MeerKAT array will follow.

Technical Specifications

MeerKAT will consist of 64 dishes of 13.5 metres in diameter each with an offset Gregorian configuration.[3] An offset dish configuration has been chosen because its unblocked aperture provides uncompromised optical performance and sensitivity, excellent imaging quality and good rejection of unwanted radio frequency interference from satellites and terrestrial transmitters. It also facilitates the installation of multiple receiver systems in the primary and secondary focal areas and is the reference design for the mid-band SKA concept.[4]

MeerKAT supports a wide range of observing modes, including deep continuum, polarisation and spectral line imaging, pulsar timing and transient searches. A range of standard data products are provided, including an imaging pipeline. A number of "data spigots" are also available to support user-provided instrumentation. Significant design and qualification efforts are planned to ensure high reliability in order to achieve low operational cost and high availability.

Technical Specifications	
Number of antennae	64
Dish diameter	13.5 m
Minimum baseline	29 m
Maximum baseline	20 km
Frequency bands (receivers)	0.58 – 1.015 GHz 1 – 1.75 GHz 8 – 14.5 GHz
Continuum imaging dynamic range at 1.4 GHz	60 dB
Line-to-line dynamic range at 1.4 GHz	40 dB
Mosaicing imaging dynamic range at 1.4 GHz	27 dB
Linear polarisation cross coupling across -3 dB beam	-30 dB

MeerKAT's 64 dishes will be distributed over two components:

- A dense inner component containing 70% of the dishes. These are distributed in a two-dimensional fashion with a Gaussian uv-distribution with a dispersion of 300 m, a shortest baseline of 29 m and a longest baseline of 1 km.
- An outer component containing 30% of the dishes. These are also distributed in a two-dimensional Gaussian uv-distribution with a dispersion of 2 500 m and a longest baseline of 8 km.

For Phase 2, seven additional antennae will be added to extend the longest baselines to about 20 km.

Construction Schedule

To build experience in the construction of interferometric telescopes, members of the Karoo Array Telescope constructed the Phased Experimental Demonstrator (PED) at the South African Astronomical Observatory in Cape Town between 2005 and 2007.[5]

During 2007 the 15 metres (49 ft) eXperimental Development Model Telescope (XDM) was built at the Hartebeesthoek Radio Astronomy Observatory to serve as a testbed for MeerKAT.[6]

Construction of the MeerKAT Precursor Array (MPA - also known as KAT-7), on the site started in August 2009.[7] The first seven dishes are complete. In April 2010 four of the seven dishes were linked together as an integrated system to produce its first interferometric image of an astronomical object. In Dec 2010, there was a successful detection of very long baseline

interferometry (VLBI) fringes between the Hartebeesthoek Radio Astronomy Observatory 26 m dish and one of the KAT-7 dishes.[8]

Despite original plans to complete MeerKAT by 2012[9], construction was suspended in late 2010 due to budget restructure. Science Minister Naledi Pandor denied the suspension marked any setback to the SKA project or 'external considerations'.[10] MeerKAT construction received no funding in 2010/11 and 2011/12.[11] The 2012 South African National Budget projected that just 15 MeerKAT antennae would be completed by 2015.[12]

MeerKAT will be delivered in three phases. The commissioning of MeerKAT will take place in 2014 and 2015 with the array coming online for science operations in 2016. This phase will include all the antennae but only the first receiver will be fitted. A processing bandwidth of 750 MHz will be available. For the second and third phases the remaining two receivers will be fitted and the processing bandwidth will be increased to at least 2 GHz, with a goal of 4 GHz.

MeerKAT Phasing Schedule

	2011	**2016**	**2018**
	Precursor (KAT-7)	**MeerKAT Phase 1**	**MeerKAT Phase 2 and 3**
Number of dishes	7	64	64
Receiver bands (GHz)	0.9 – 1.6	1.00 – 1.75	0.58 – 1.015 1.00 – 1.75 8 – 14.5
Max processed BW (GHz)	0.256	0.75	2 (goal 4)
Max baseline (km)	0.2	8	20
Min baseline (m)	20	29	29

MeerKAT Science

Five years of observing time on MeerKAT have been allocated to leading astronomers who have applied for time to do research. The science objectives of the MeerKAT surveys are in line with the prime science drivers for the first phase of the SKA, confirming MeerKAT's designation as an SKA precursor instrument.

Science Projects	**Research Leaders**
Testing Einstein's theory of gravity and gravitational radiation – Investigating the physics of enigmatic neutron stars through observations of pulsars.	Prof Matthew Bailes, Swinburne Centre for Astrophysics and Supercomputing, Australia
LADUMA (Looking At the Distant Universe with the MeerKAT Array)[13] – An ultra-deep survey of neutral hydrogen gas in the early universe.	Dr Sarah Blyth, University of Cape Town, South Africa Dr Benne Holwerda, European Space Agency, The Netherlands Dr Andrew Baker, Rutgers University, United States

MESMER (MeerKAT Search for Molecules in the Epoch of Reionization) – Searching for CO at high red-shift (z>7) to investigate the role of molecular hydrogen in the early universe.	Dr Ian Heywood, University of Oxford, United Kingdom
MeerKAT Absorption Line Survey for atomic hydrogen and OH lines in absorption against distant continuum sources (OH line ratios may give clues about changes in the fundamental constants in the early universe).	Dr Neeraj Gupta, ASTRON, The Netherlands Dr Raghunathan Srianand, Inter-University Centre for Astronomy and Astrophysics, India
MHONGOOSE (MeerKAT HI Observations of Nearby Galactic Objects: Observing Southern Emitters) – Investigations of different types of galaxies, dark matter and the cosmic web.	Prof Erwin de Blok, University of Cape Town, South Africa
TRAPUM (Transients and Pulsars with MeerKAT) – Searching for and investigating new and exotic pulsars.	Dr Benjamin Stappers, Jodrell Bank Centre for Astrophysics, United Kingdom Prof Michael Kramer, Max Planck Institute for Radio Astronomy, Germany
A MeerKAT HI Survey of the Fornax Cluster (Galaxy formation and evolution in the cluster environment).	Dr Paolo Serra, ASTRON, The Netherlands
MeerGAL (MeerKAT High Frequency Galactic Plane Survey) – Galactic structure and dynamics, distribution of ionised gas, recombination lines, interstellar molecular gas and masers.	Dr Mark Thompson, University of Hertfordshire, United Kingdom Dr Sharmila Goedhart, SKA South Africa, South Africa
MIGHTEE (MeerKAT International GigaHertz Tiered Extragalactic Exploration survey) – Deep continuum observations of the earliest radio galaxies.	Dr Kurt van der Heyden, University of Cape Town, South Africa Dr Matt Jarvis, University of the Western Cape, South Africa and the University of Hertfordshire, United Kingdom
ThunderKAT (The Hunt for Dynamic and Explosive Radio Transients with MeerKAT) – e.g. gamma-ray bursts, novae and supernovae, plus new types of transient radio sources.	Prof Patrick Woudt, University of Cape Town, South Africa Prof Rob Fender, University of Southampton, United Kingdom

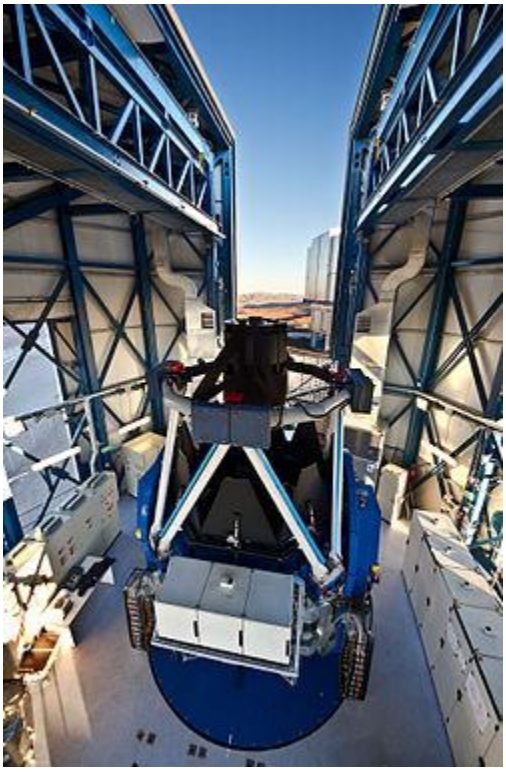
MeerKAT will also participate in global VLBI operations with all major radio astronomy observatories around the world and will add considerably to the sensitivity of the global VLBI network. Further potential science objectives for MeerKAT are to participate in the search for extraterrestrial intelligence and collaborate with NASA on downloading information from space probes.

See also

- Square Kilometer Array
- Australian Square Kilometre Array Pathfinder
- Hartebeesthoek Radio Astronomy Observatory
- List of radio telescopes
- South African Astronomical Observatory for optical astronomy in South Africa
- Precision Array for Probing the Epoch of Reionization

...VLT Survey Telescope...

VLT Survey Telescope



Organization	INAF VSTceN - ESO
Location	Cerro Paranal Observatory, Chile
Altitude	2600 m
Wavelength	from UV to I
Built	in Italy
Diameter	2.6m
Angular	0.216 arcsec/pixel

resolution	
Focal length	14416 mm
Mounting	ALT-AZ (Cassegrain)
Website	http://vstportal.oacn.inaf.it

The **VLT Survey Telescope** (**VST**) is the latest telescope to be added to ESO's Paranal Observatory in the Atacama Desert of northern Chile. It is housed in an enclosure immediately adjacent to the four Very Large Telescope (VLT) Unit Telescopes on the summit of Cerro Paranal. The VST is a wide-field survey telescope with a field of view twice as broad as the full Moon. It is the largest telescope in the world designed to exclusively survey the sky in visible light.[1]

The VST program is a cooperation between the Osservatorio Astronomico di Capodimonte (OAC), Naples, Italy, and the European Southern Observatory (ESO) that began in 1997. The OAC is one of the institute members of Istituto Nazionale di AstroFisica (INAF), which created a separate institute for the coordination of both technological and scientific aspects of the project, named Centro VST a Napoli (VSTceN). VSTcen was founded and directed by Prof. Massimo Capaccioli of the VST project, and hosted at the OAC. ESO and VSTceN collaborated in the commission phase, while ESO was responsible for the civil engineering works and the dome on site.[2] The telescope has now started observations and ESO is solely responsible for managing its operations and maintenance.[1]

Technical Information

The VST dome among VLT's telescopes. It is located in the background between two of the VLT auxiliary telescopes (small round enclosures).

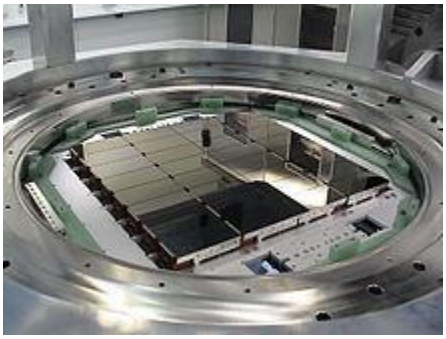
The VST is an alt-azimuthal wide-field survey telescope with a primary mirror diameter of 2.65 meters that was constructed from 2007-2011 at the ESO Cerro Paranal Observatory, in Chile. With a field of view of one square degree (roughly two full moons), its main scientific role is as a wide-field imaging instrument for exploring the large-scale structure of the universe (as visible from the southern hemisphere), able to identify the most suitable candidates for detailed examination by the VLT.[2] Together with its camera OmegaCAM, the VST is able to obtain a

high angular resolution (0.216 arcsec/pixel), and it is capable of performing stand-alone survey projects in the visible part of the spectrum.[3]

The VST at the integration site in Italy

Telescope Optics

The telescope has two mirrors, the primary (M1) and a smaller secondary mirror (M2), which reflect light from the sky down to the OmegaCAM camera. Both mirrors are made from a crystalline ceramic material called Sitall, specifically chosen for its low coefficient of thermal expansion. The VST primary mirror is the larger of the two, with a diameter of 265 cm and a thickness of 14 cm. The secondary mirror is less than half the size of M1 with a diameter of just 93.8 cm and a thickness of 13 cm.[4] VST's original optical components were manufactured at the Lytkarino Glass Factory, Moscow and were accepted in September 2001.[5]



The OmegaCAM camera lies at the heart of the VST. This view shows its 32 CCD detectors that together create 268-megapixel images.

A computer-controlled active optics system controls the shape of M1 and the position of M2. This technology preserves the optical image quality by keeping the mirrors perfectly positioned at all times. M1 is continuously reshaped by an actuator network (84 axial motors distributed under the mirror surface and 24 radial dislocated laterally) able to locally correct the optical surface. Also in the primary mirror cell is another instrument able to modify the telescope's optical configuration by moving from a corrector composed by a double set of lenses, to an ADC (Atmospherical Dispersion Corrector) composed by a counter-rotating set of prisms, potentially able to correct the optical dispersion phenomena due to the variation of air mass induced by

changing the altitude angle. The secondary mirror is actively controlled by a double deformable platform (hexapod) able to tilt the mirror during exposure. The active optics system also includes a wavefront sensor (Shack-Hartmann), mounted under the primary mirror cell together with the local guide system, able to furnish the optical correction feedback. These systems give the VST the capability to be autonomous in terms of both guiding (tracking) and active optics control.[5][6]

OmegaCAM: The VST Camera

At its Cassegrain focus, the VST hosts an imaging wide-field camera (OmegaCAM), comprising a mosaic of 32 2Kx4K CCDs (268 megapixels total), and produced by an international consortium between the Netherlands, Germany, Italy, and the ESO.[7] Design features of OmegaCAM include four auxiliary CCD cameras, two for auto-guiding and two for on-line image analysis. Up to 12 filters can be used, ranging from ultraviolet to near-infrared. The entire detector system operates in vacuum at about -140 degrees Celsius behind a large dewar window. This window not only protects the detectors from air and moisture, but also acts as an additional corrector lens.[8]

VST image of the star-forming region Messier 17.

VST Surveys

The primary function of the VST is to support the Very Large Telescope by providing surveys — both extensive, multi-colour imaging surveys and more specific searches for rare astronomical objects. Three have already been planned as part of the Public Surveys Project, and they are anticipated to take five years to carry out. These are the Kilo-Degree Survey (KIDS), VST ATLAS and the VST Photometric Hα Survey of the Southern Galactic Plane (VPHAS+). They will focus on a wide range of astronomical issues from searching for highly energetic quasars to understanding the nature of dark energy.[9] More information about the surveys can be found on the ESO - The VST Surveys website.

The data volume produced by OmegaCAM will be large. About 30 terabytes of raw data will be produced per year and will flow back into data centres in Europe for processing. A novel and sophisticated software system has been developed at Groningen and Naples to handle the very

large data flow. The end products from the processing will be huge lists of the objects found, as well as images, and these will be made available to astronomers worldwide for scientific analysis.[1] Funding for the data analysis was uncertain in 2011.[10]

Construction

The construction of the VST suffered several unfortunate mishaps, which were mostly the result of *force majeure* and outside the control of the builders. The first primary mirror was destroyed in 2002 while being transported from Europe to Chile. M2 was also damaged during shipping, albeit slightly, and had to be returned for repairs. Although a series of emergency actions was enforced to resolve these problems with minimum impact on the VST schedule, the telescope suffered some delays. But now, with M2 repaired and the M1 replica mirror verified to have the outstanding quality of the original, the construction of the VST is finally complete.[4] Testing was finished in Italy and the telescope was dismounted, painted and packed, then shipped and mounted at Paranal. The first parts arrived in June 2007, and the first phase of integration at Paranal was completed in April, 2008.[6] The first images from the VST were released on June 8, 2011.[1]

Science with the VST

In planetary science, the survey telescope aims to discover and study remote Solar System bodies such as trans-Neptunian objects, as well as search for extrasolar planet transits. The Galactic plane will also be extensively studied with VST, which will look for signatures of tidal interactions in the Milky Way, and will provide astronomers with data crucial to understand the structure and evolution of our Galaxy. Further afield, the VST will explore nearby galaxies, extragalactic and intra-cluster planetary nebulae, and will perform surveys of faint object and micro-lensing events. The telescope will also peer into the distant Universe to help astronomers find answers to long-standing questions in cosmology. It will target medium-redshift supernovae to help pin down the cosmic distance scale and understand the expansion of the Universe. The VST will also look for cosmic structures at medium-high redshift, active galactic nuclei and quasars to further our understanding of galaxy formation and the Universe's early history.[11]

Globular star cluster Omega Centauri as seen by the VST.

Through the VST ATLAS survey, the telescope will target one of the most fundamental questions in astrophysics today: the nature of dark energy. The survey aims to detect small-amplitude oscillations known as ′baryon wiggles' that can be detected in the power-spectrum of galaxies and are the imprint of sound waves in the early Universe on the distribution of matter. The dark energy equation of state can be determined by measuring the features of these oscillations. Extrapolating from previous surveys, it is very likely that the VST will make some unexpected discoveries with major consequences for the current understanding of the Universe.[11]

VST's view of the Leo Triplet and beyond.

First Images of the VST

The first released VST image (above on the left) shows the spectacular star-forming region Messier 17, also known as the Omega Nebula or the Swan Nebula, as it has never been seen before. This vast region of gas, dust and hot young stars lies in the heart of the Milky Way in the constellation of Sagittarius (The Archer). The VST field of view is so large that the entire nebula, including its fainter outer parts, is captured — and retains its superb sharpness across the entire image. The data were processed using the Astro-WISE software system developed by E.A. Valentijn and collaborators at Groningen and elsewhere.[1]

The second released VST image (left) may be the best portrait of the globular star cluster Omega Centauri ever made. Omega Centauri, in the constellation of Centaurus (The Centaur), is the largest globular cluster in the sky, but the very wide field of view of VST and its powerful camera OmegaCAM can encompass even the faint outer regions of this spectacular object. The view seen on the left includes about 300 000 stars. The data were processed using the VST-Tube system developed by A. Grado and collaborators at the INAF-Capodimonte Observatory.[1]

The third released VST image (right) shows a triplet of bright galaxies in the constellation of Leo (The Lion), together with a multitude of fainter objects: distant background galaxies and much closer Milky Way stars. The image hints at the power of the VST and OmegaCAM for surveying the extragalactic Universe and for mapping the low brightness objects of the galactic halo. The image on the left is a composite created by combining exposures taken through three different

filters. Light that passed through a near-infrared filter was coloured red, red light is coloured green, and green light is coloured magenta.[12]

...Vatican Advanced Technology Telescope...

Vatican Advanced Technology Telescope

from ground level

Organization	Vatican Observatory Research Group
Code	290
Location	Mount Graham International Observatory, Mount Graham, Graham County, Arizona, United States
Coordinates	32°42′4.78″N 109°53′32.54″WCoordinates: 32°42′4.78″N 109°53′32.54″W
Altitude	3178 m

Website
vaticanobservatory.org

Telescopes

VATT from the balcony of the nearby LBT

The **Vatican Advanced Technology Telescope**, aka the VATT, is a 1.8 meter Gregorian telescope observing in the optical and infrared. It is part of the Mount Graham International Observatory. It is situated on Mount Graham in southeast Arizona, and it achieved 'first light', the first starlight to pass through the telescope onto a detector, in 1993. It is operated by the Vatican Observatory, one of the oldest astronomical research institutions in the world, in partnership with The University of Arizona.

The heart of the telescope is an f/1.0 honeycombed construction, borosilicate primary mirror. The mirror was manufactured at The University of Arizona's Steward Observatory Mirror Laboratory[1], which pioneered both the spin-casting and the stressed-lap polishing techniques which are being used for telescope mirrors that include the 6.5 meter aperture MMT and Magellan telescopes and the two 8.4 meter mirrors of the Large Binocular Telescope. The VATT's mirror is unusually 'fast', f/1, which means that its focal distance is equal to its diameter. Because it has such a short focal length, a Gregorian design could be employed which uses a concave secondary mirror at a point beyond the primary focus; this allows unusually sharp focusing across the field of view.

The unusual optical design and novel mirror fabrication techniques mean that both the primary and secondary mirrors are among the most exact surfaces ever made for a ground-based telescope. In addition, the skies above Mount Graham are among the most clear, steady, and dark in the continental North America. Seeing of better than one arc-second even without adaptive optics can be achieved on a regular basis.

Optical System	*Aplanatic Gregorian* f/9
Focal Length	16.48 m
Primary Mirror	f/1.0, Diameter 1.83 m
	f/0.9, Diameter 0.38 m
Secondary Mirror	
	(Focus Control: 0.1 micrometre)
Field of View	72 mm (15')
Scale	12.52 "/mm
Image Quality	0.1 ' - 6.8 "

Mount Alt-Az + Derotator

Given its excellent optical qualities, the telescope has been used primarily for imaging and photometric work, in which it regularly outperforms much larger telescopes located elsewhere. Among the notable results from this telescope have been the discovery of MACHOs in the Andromeda Galaxy; the validation of the Stromvil photometric filter system; evidence for how the shape and dimensions of galaxies have changed over the age of the universe; discovery of the first binary 'Vesta chip' asteroid; and the characterization and classification by visible colors of some 100 Trans-Neptunian objects, most of them fainter than magnitude 21.

The government of the Vatican City State supports the Vatican Observatory staff and regular research costs, but the cost to build and maintain the VATT itself has come from private donors. The major donors supporting the construction of the telescope were Fred and Alice P. Lennon and Thomas J. Bannan. Benefactors to the Vatican Observatory Foundation[2] continue to support the operating costs of the Alice P. Lennon telescope and its attached Thomas J. Bannan astrophysics facility.

...Australian Square Kilometre Array Pathfinder...

Australian SKA Pathfinder

CSIRO's ASKAP antennas at the MRO in Western Australia. Credit: Ant Schinckel, CSIRO.

Organization CSIRO

Location	Murchison Radio-astronomy Observatory, Western Australia, Australia
Coordinates	26.7°S 116.5°ECoordinates: 26.7°S 116.5°E

The **Australian Square Kilometre Array Pathfinder**, or ASKAP, is CSIRO's new radio telescope currently under construction at the Murchison Radio-astronomy Observatory (MRO) in Mid West region of Western Australia. The Wajarri Yamatji people are the traditional owners of the land on which the observatory lies. Construction on ASKAP began in late 2009 and is expected to be completed by 2013.[1]

ASKAP's combination of fast survey speed and high sensitivity will allow astronomers to answer some fundamental questions about the creation and early evolution of our Universe, and to test theories of cosmic magnetism and predictions from Einstein's theory of general relativity.[2]

ASKAP will also be an important technology demonstrator for the international Square Kilometre Array (SKA) project, a future international radio telescope that will be the world's largest and most sensitive.[3] In addition, ASKAP's home, the MRO, was selected as the central site for major components of SKA telescope infrastructure in Australia. SKA telescope will also be deployed in southern Africa.[4]

Description

Development and construction of ASKAP is being led by CSIRO Astronomy and Space Science (CASS), in collaboration with scientists and engineers in The Netherlands, Canada and the USA, as well as colleagues from Australian universities and industry partners in China.[1]

Once built, ASKAP will form part of CSIRO's Australia Telescope National Facility along with existing telescopes at Parkes, Narrabri and Mopra.[5]

Design

External videos

Watch a video of the first ASKAP antenna construction at the MRO in January 2010.

ASKAP is made up of 36 identical antennas, each 12 metres in diameter, working together as a single instrument to achieve a total collecting area of approximately 4,000 square metres. The construction and assembly of the dishes was completed in June 2012[6].

The unique features that will make ASKAP an unprecedented synoptic telescope include a wide field-of-view, large spectral bandwidth, extremely fast survey speed, and excellent u-v coverage.[7]

ASKAP is located in the Murchison district in Western Australia, a region that is extremely "radio-quiet" due to the low population density and resultant lack of radio interference (generated by human activity) that would otherwise interfere with weak astronomical signals.[8]

The unique radio quiet nature is being recognised as a natural resource and is being protected by the Australian Commonwealth and Western Australia State Government through a range of protective regulatory measures.

Data from ASKAP will be transmitted from the MRO to a supercomputer at the Pawsey Supercomputing Centre in Perth. The data will be converted to images of the sky in near-real-time by a pipeline processor running the purpose-built ASKAPsoft package.[9] All data will be placed in the public domain after being checked for quality by the ten ASKAP Survey Science Teams. Post processing will be supported by the Pawsey Centre[10] supercomputer in Perth, and may also be complemented by 'theSkyNet',[11] a "community computing initiative"[12] similar to Seti@home.

Science

During ASKAP's first five years of operation, at least 75% of its time will be used for large Survey Science Projects. ASKAP is expected to make substantial advances in key areas, including the following:[13]

1. Galaxy formation and gas evolution in the nearby Universe through extragalactic HI surveys
2. Evolution, formation and population of galaxies across cosmic time via high resolution, continuum surveys
3. Characterisation of the radio transient sky through detection and monitoring (including VLBI) of transient and variable sources, and
4. Evolution of magnetic fields in galaxies over cosmic time through polarisation surveys.

ASKAP Survey Science Projects

In 2009, after an open call for proposals, CSIRO announced that ten major science projects had been selected to use ASKAP.[14] Of the ten projects' authors, 33% were from Australia and New Zealand, 30% from North America, 28% from Europe, and 9% from elsewhere in the world.

The ten ASKAP Survey Science Projects are:

- EMU: Evolutionary Map of the Universe [1]
- WALLABY: Widefield ASKAP L-Band Legacy All-Sky Blind Survey [2]
- FLASH: The First Large Absorption Survey in HI [3]
- VAST: An ASKAP Survey for Variables and Slow Transients [4]
- GASKAP: The Galactic ASKAP Spectral Line Survey [5]
- POSSUM: Polarization Sky Survey of the Universe's Magnetism [6]
- CRAFT: The Commensal Real-time ASKAP Fast Transients survey
- DINGO: Deep Investigations of Neutral Gas Origins [7]

- VLBI: The High Resolution Components of ASKAP: Meeting the Long Baseline Specifications for the SKA
- COAST: Compact Objects with ASKAP: Surveys and Timing

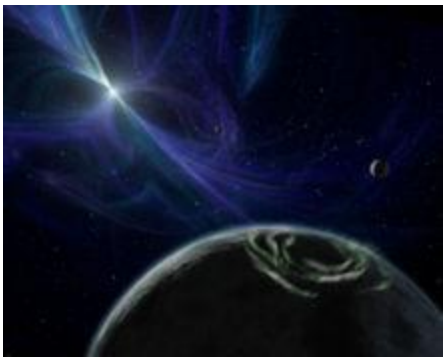
Established detection methods

Radial velocity

- Main articles: Doppler spectroscopy and List of extrasolar planets detected by radial velocity
- A star with a planet will move in its own small orbit in response to the planet's gravity. This leads to variations in the speed with which the star moves toward or away from Earth, i.e. the variations are in the radial velocity of the star with respect to Earth. The radial velocity can be deduced from the displacement in the parent star's spectral lines due to the Doppler effect. The radial-velocity method measures these variations in order to confirm the presence of the planet.
- The velocity of the star around the system's center of mass is much smaller than that of the planet, because the radius of its orbit around the center of mass is so small. However, velocity variations down to 1 m/s or even somewhat less can be detected with modern spectrometers, such as the HARPS (High Accuracy Radial Velocity Planet Searcher) spectrometer at the ESO 3.6 meter telescope in La Silla Observatory, Chile, or the HIRES spectrometer at the Keck telescopes. An especially simple and inexpensive method for measuring radial velocity is "externally dispersed interferometry". [2]
- The radial-velocity method has been by far the most productive technique used by planet hunters. It is also known as Doppler spectroscopy. The method is distance independent, but requires high signal-to-noise ratios to achieve high precision, and so is generally only used for relatively nearby stars out to about 160 light-years from Earth. It easily finds massive planets that are close to stars, but detection of those orbiting at great distances requires many years of observation. Planets with orbits highly inclined to the line of sight from Earth produce smaller wobbles, and are thus more difficult to detect. One of the main disadvantages of the radial-velocity method is that it can only estimate a planet's minimum mass. The posterior distribution of the inclination angle depends on the true mass distribution of the planets. The radial-velocity method can be used to confirm findings made by using the transit method. When both methods are used in combination, then the planet's true mass can be estimated.
- Although radial-velocity of the star only gives a planet's minimum mass, if the planet's spectral lines can be distinguished from the star's spectral lines then the radial-velocity of the planet itself can be found and this gives the inclination of the planet's orbit and therefore the planet's actual mass can be determined.[3]

Pulsar timing

- See also: List of extrasolar planets detected by timing

- 
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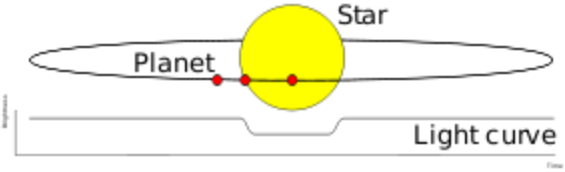
- Artist's impression of the pulsar PSR 1257+12's planetary system
- A pulsar is a neutron star: the small, ultradense remnant of a star that has exploded as a supernova. Pulsars emit radio waves extremely regularly as they rotate. Because the intrinsic rotation of a pulsar is so regular, slight anomalies in the timing of its observed radio pulses can be used to track the pulsar's motion. Like an ordinary star, a pulsar will move in its own small orbit if it has a planet. Calculations based on pulse-timing observations can then reveal the parameters of that orbit.[4]
- This method was not originally designed for the detection of planets, but is so sensitive that it is capable of detecting planets far smaller than any other method can, down to less than a tenth the mass of Earth. It is also capable of detecting mutual gravitational perturbations between the various members of a planetary system, thereby revealing further information about those planets and their orbital parameters.
- The main drawback of the pulsar-timing method is that pulsars are relatively rare, so it is unlikely that a large number of planets will be found this way. Also, life *as we know it* could not survive on planets orbiting pulsars since high-energy radiation there is extremely intense.
- In 1992 Aleksander Wolszczan and Dale Frail used this method to discover planets around the pulsar PSR 1257+12.[5] Their discovery was quickly confirmed, making it the first confirmation of planets outside our Solar System.
- **Transit method**
- See also: List of transiting extrasolar planets
- 

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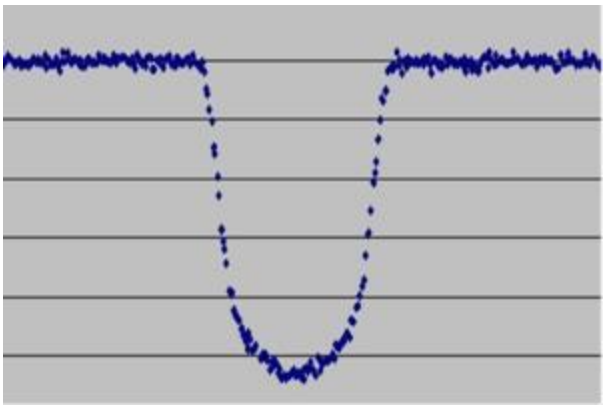
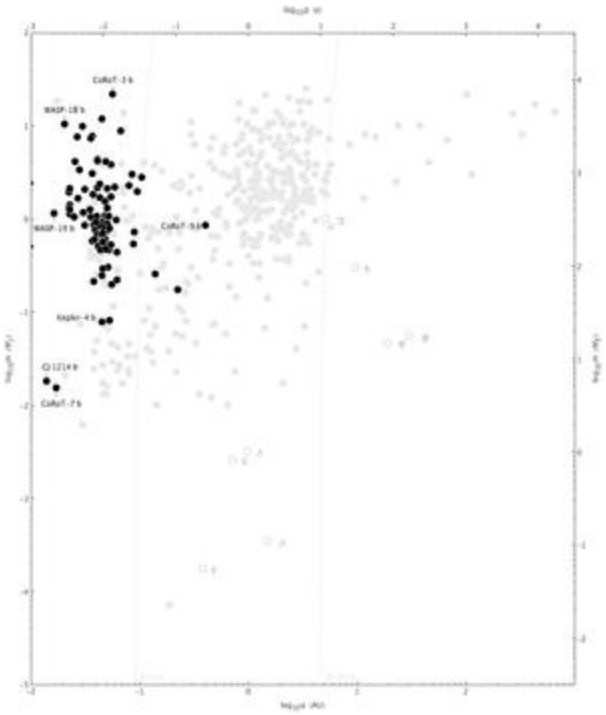
- Transit method of detecting extrasolar planets. The graph below the picture demonstrates the light levels received over time by Earth.

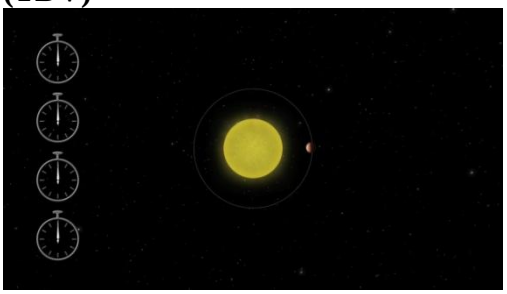


- Kepler 6b photometry.[6]
- While the above methods provide information about a planet's mass, this photometric method can determine the radius of a planet. If a planet crosses (transits) in front of its parent star's disk, then the observed visual brightness of the star drops a small amount. The amount the star dims depends on the relative sizes of the star and the planet. For example, in the case of HD 209458, the star dims 1.7%.
- This method has two major disadvantages. First of all, planetary transits are only observable for planets whose orbits happen to be perfectly aligned from the astronomers' vantage point. The probability of a planetary orbital plane being directly on the line-of-sight to a star is the ratio of the diameter of the star to the diameter of the orbit. About 10% of planets with small orbits have such alignment, and the fraction decreases for planets with larger orbits. For a planet orbiting a sun-sized star at 1 AU, the probability of a random alignment producing a transit is 0.47%. Therefore the method cannot answer the question of whether any particular star is a host to planets. However, by scanning large areas of the sky containing thousands or even hundreds of thousands of stars at once, transit surveys can in principle find extrasolar planets at a rate that could potentially exceed that of the radial-velocity method.[7] Several surveys have taken that approach, such as the ground-based MEarth Project and the space-based COROT and Kepler missions.
- Secondly, the method suffers from a high rate of false detections. A transit detection requires additional confirmation, typically from the radial-velocity method.[8]



- Properties (mass and semimajor axis) of planets discovered using the transit method, compared (light gray) with planets discovered using other methods.
- The main advantage of the transit method is that the size of the planet can be determined from the lightcurve. When combined with the radial-velocity method (which determines the planet's mass) one can determine the density of the planet, and hence learn something about the planet's physical structure. The nine planets that have been studied by both methods are by far the best-characterized of all known exoplanets.[9]
- The transit method also makes it possible to study the atmosphere of the transiting planet. When the planet transits the star, light from the star passes through the upper atmosphere of the planet. By studying the high-resolution stellar spectrum carefully, one can detect elements present in the planet's atmosphere. A planetary atmosphere (and planet for that matter) could also be detected by measuring the polarisation of the starlight as it passed through or is reflected off the planet's atmosphere.
- Additionally, the secondary eclipse (when the planet is blocked by its star) allows direct measurement of the planet's radiation. If the star's photometric intensity during the secondary eclipse is subtracted from its intensity before or after, only the signal caused by the planet remains. It is then possible to measure the planet's temperature and even to detect possible signs of cloud formations on it. In March 2005, two groups of scientists carried out measurements using this technique with the Spitzer Space Telescope. The two teams, from the Harvard-Smithsonian Center for Astrophysics, led by David Charbonneau, and the Goddard Space Flight Center, led by L. D. Deming, studied the planets TrES-1 and HD 209458b respectively. The measurements revealed the planets' temperatures: 1,060 K (790°C) for TrES-1 and about 1,130 K (860°C) for HD 209458b.[10][11] In addition the hot Neptune Gliese 436 b enters secondary eclipse. However some transiting planets orbit such that they do not enter secondary eclipse relative to Earth; HD 17156 b is over 90% likely to be one of the latter.

- A French Space Agency mission, COROT, began in 2006 to search for planetary transits from orbit, where the absence of atmospheric scintillation allows improved accuracy. This mission was designed to be able to detect planets "a few times to several times larger than Earth" and is currently performing "better than expected", with two exoplanet discoveries[12] (both "hot jupiter" type) as of early 2008. The 17th CoRoT exoplanet was announced in 2010.
- In March 2009, NASA mission Kepler was launched to scan a large number of stars in the constellation Cygnus with a measurement precision expected to detect and characterize Earth-sized planets. The NASA Kepler Mission uses the transit method to scan a hundred thousand stars in the constellation Cygnus for planets. It is hoped that by the end of its mission of 3.5 years, the satellite will have collected enough data to reveal planets even smaller than Earth. By scanning a hundred thousand stars simultaneously, it will not only be able to detect Earth-sized planets, it will be able to collect statistics on the numbers of such planets around sunlike stars.[13]
- On February 2, 2011, the Kepler team released a list of 1,235 extrasolar planet candidates, including 54 that may be in the habitable zone. On December 5, 2011, the Kepler team announced that they had discovered 2,326 planetary candidates, of which 207 are similar in size to Earth, 680 are super-Earth-size, 1,181 are Neptune-size, 203 are Jupiter-size and 55 are larger than Jupiter. Compared to the February 2011 figures, the number of Earth-size and super-Earth-size planets increased by 200% and 140% respectively. Moreover, 48 planet candidates were found in the habitable zones of surveyed stars, marking a decrease from the February figure; this was due to the more stringent criteria in use in the December data.[*citation needed*]
- **Transit timing variation method (TTV) and transit duration variation method (TDV)**



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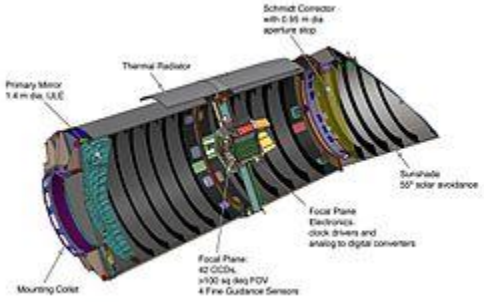
- Animation showing difference between planet transit timing of 1-planet and 2-planet systems. Credit: NASA/Kepler Mission.



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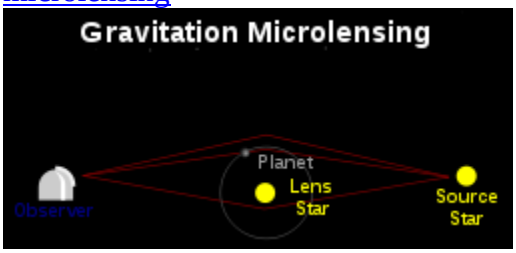
- The Kepler Mission, A NASA mission which is able to detect extrasolar planets

- If a planet has been detected by the transit method, then variations in the timing of the transit provide an extremely sensitive method which is capable of detecting additional planets in the system with sizes potentially as small as Earth-sized planets.[14][15][16] The first significant detection of a non-transiting planet using TTV was carried out with NASA's Kepler satellite. The transiting planet Kepler-19b shows TTV with an amplitude of 5 minutes and a period of about 300 days, indicating the presence of a second planet, Kepler-19c, which has a period which is a near rational multiple of the period of the transiting planet [17][18]
- "Timing variation" asks whether the transit occurs with strict periodicity or if there's a variation. "Duration variation" asks how long the transit takes. Duration variations may be caused by an exomoon.[19]
- **Orbital phase reflected light variations**
- Short period giant planets in close orbits around their stars will undergo reflected light variations changes because, like the Moon, they will go through phases from full to new and back again. Since telescopes cannot resolve the planet from the star, they see only the combined light, and the brightness of the host star seems to change over each orbit in a periodic manner. Although the effect is small — the photometric precision required is about the same as to detect an Earth-sized planet in transit across a solar-type star — such Jupiter-sized planets are detectable by space telescopes such as the Kepler Space Observatory. In the long run, this method may find the most planets that will be discovered by that mission because the reflected light variation with orbital phase is largely independent of orbital inclination of the planet's orbit and does not require the planet to pass in front of the disk of the star. In addition, the phase function of the giant planet is also a function of its thermal properties and atmosphere, if any. Therefore the phase curve may constrain other planet properties, such as the particle size distribution of the atmospheric particles.[20]
- Both Corot[21] and Kepler[22] have measured the reflected light from planets. However, these planets were already known since they transit their host star. The first planets discovered by this method are KOI 55.01 and 55.02, found by Kepler.[23]
- **Gravitational microlensing**
- Main articles: Gravitational microlensing and List of extrasolar planets detected by microlensing
- 

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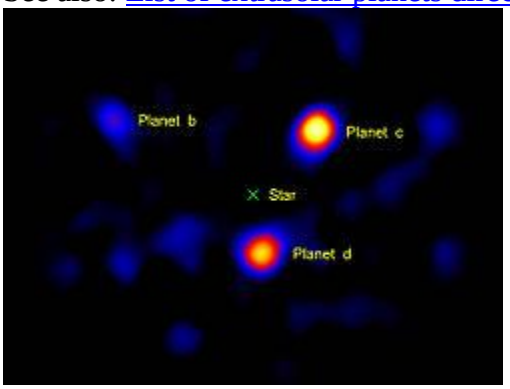
- Gravitational Microlensing
- Gravitational microlensing occurs when the gravitational field of a star acts like a lens, magnifying the light of a distant background star. This effect occurs only when the two stars are almost exactly aligned. Lensing events are brief, lasting for weeks or days, as the two stars and Earth are all moving relative to each other. More than a thousand such events have been observed over the past ten years.

- If the foreground lensing star has a planet, then that planet's own gravitational field can make a detectable contribution to the lensing effect. Since that requires a highly improbable alignment, a very large number of distant stars must be continuously monitored in order to detect planetary microlensing contributions at a reasonable rate. This method is most fruitful for planets between Earth and the center of the galaxy, as the galactic center provides a large number of background stars.
- In 1991, astronomers Shude Mao and Bohdan Paczyński of Princeton University first proposed using gravitational microlensing to look for exoplanets. Successes with the method date back to 2002, when a group of Polish astronomers (Andrzej Udalski, Marcin Kubiak and Michał Szymański from Warsaw, and Bohdan Paczyński) during project OGLE (the Optical Gravitational Lensing Experiment) developed a workable technique. During one month they found several possible planets, though limitations in the observations prevented clear confirmation. Since then, four confirmed extrasolar planets have been detected using microlensing. As of 2006 this was the only method capable of detecting planets of Earthlike mass around ordinary main-sequence stars.[24]
- A notable disadvantage of the method is that the lensing cannot be repeated because the chance alignment never occurs again. Also, the detected planets will tend to be several kiloparsecs away, so follow-up observations with other methods are usually impossible. However, if enough background stars can be observed with enough accuracy then the method should eventually reveal how common earth-like planets are in the galaxy.
- Observations are usually performed using networks of robotic telescopes. In addition to the European Research Council-funded OGLE, the Microlensing Observations in Astrophysics (MOA) group is working to perfect this approach.
- The PLANET (Probing Lensing Anomalies NETwork)/RoboNet project is even more ambitious. It allows nearly continuous round-the-clock coverage by a world-spanning telescope network, providing the opportunity to pick up microlensing contributions from planets with masses as low as Earth. This strategy was successful in detecting the first low-mass planet on a wide orbit, designated OGLE-2005-BLG-390Lb.[24]
- **Direct imaging**
- See also: List of extrasolar planets directly imaged
- 

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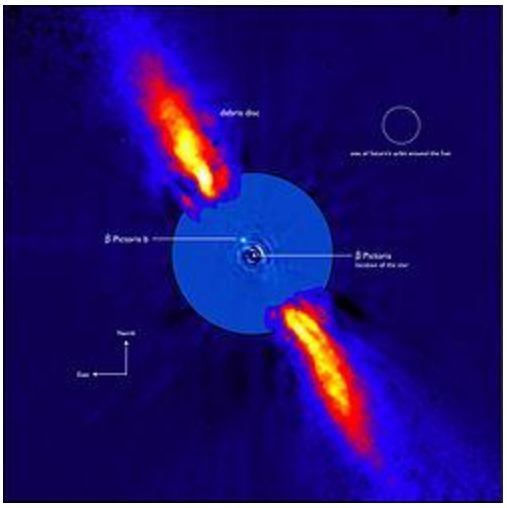
- Direct image of exoplanets around the star HR8799 using a vortex coronograph on a 1.5m portion of the Hale telescope

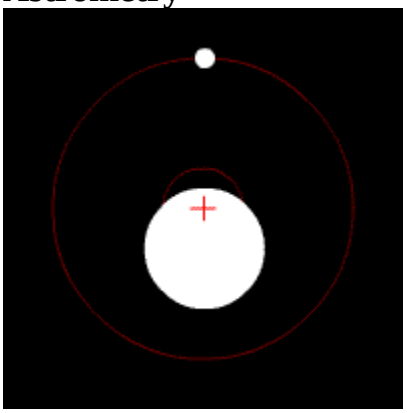


- ESO image of a planet near Beta Pictoris.
- As mentioned previously, planets are extremely faint light sources compared to stars and what little light comes from them tends to be lost in the glare from their parent star. So in general, it is very difficult to detect them directly. It is easier to obtain images when the planet is especially large (considerably larger than Jupiter), widely separated from its parent star, and hot so that it emits intense infrared radiation; the images have then been made at infrared where the planet is brighter than it is at visible wavelengths. Coronagraphs are used to block light from the star while leaving the planet visible.
- **Early discoveries**
- In 2004, a group of astronomers used the European Southern Observatory's Very Large Telescope array in Chile to produce an image of 2M1207b, a companion to the brown dwarf 2M1207.[25] In the following year the planetary status of the companion was confirmed.[26] The planet is believed to be several times more massive than Jupiter and to have an orbital radius greater than 40 AU.
- In September 2008, an object was imaged at a separation of 330AU from the star 1RXS J160929.1−210524, but it was not until 2010 that it was confirmed to be a companion planet to the star and not just a chance alignment.[27]
- The first multiplanet system, announced on 13 November 2008, was imaged in 2007 using telescopes at both Keck Observatory and Gemini Observatory. Three planets were directly observed orbiting HR 8799, whose masses are approximately 10, 10 and 7 times that of Jupiter.[28][29] On the same day, 13 November 2008, it was announced that the Hubble Space Telescope directly observed an exoplanet orbiting Fomalhaut with mass no more than $3M_J$.[30] Both systems are surrounded by disks not unlike the Kuiper belt.
- In 2009 it was announced that analysis of images dating back to 2003 revealed a planet orbiting Beta Pictoris.
- An additional system, GJ 758, was imaged in November 2009, by a team using the HiCIAO instrument of the Subaru Telescope but it was a brown dwarf.[31]
- Other possible exoplanets to have been directly imaged: GQ Lupi b, AB Pictoris b, and SCR 1845 b.[32] As of March 2006 none have been confirmed as planets; instead, they might themselves be small brown dwarfs.[33][34]
- **Imaging instruments**

- In 2010 a team from NASAs Jet Propulsion Laboratory demonstrated that a vortex coronagraph could enable small scopes to directly image planets.[35] They did this by imaging the previously imaged HR 8799 planets using just a 1.5 m portion of the Hale Telescope.
- Another promising approach is nulling interferometry.[36]
- It has also been proposed that space-telescopes that focus light using zone plates instead of mirrors would provide higher-contrast imaging and be cheaper to launch into space due to being able to fold up the lightweight foil zone plate.[37]
- Some projects to equip telescopes with planet-imaging-capable instruments include: Gemini Planet Imager, VLT-SPHERE, Subaru-HiCIAO and Palomar Project 1640.

Other possible methods

- **Astrometry**



- In this diagram a planet (smaller object) orbits a star, which itself moves in a small orbit. The system's center of mass is shown with a red plus sign. (In this case, it always lies within the star.)
- This method consists of precisely measuring a star's position in the sky and observing how that position changes over time. Originally this was done visually with hand-written records. By the end of the 19th century this method used photographic plates, greatly improving the accuracy of the measurements as well as creating a data archive. If the star has a planet, then the gravitational influence of the planet will cause the star itself to move in a tiny circular or elliptical orbit. Effectively, star and planet each orbit around their mutual center of mass (barycenter), as explained by solutions to the two-body problem. Since the star is much more massive, its orbit will be much smaller.[38] Frequently, the mutual center of mass will lie within the radius of the larger body.

- Motion of the center of mass (barycenter) of solar system relative to the Sun.
- Astrometry is the oldest search method for extrasolar planets and originally popular because of its success in characterizing astrometric binary star systems. It dates back at least to statements made by William Herschel in the late 18th century. He claimed that an *unseen companion* was affecting the position of the star he cataloged as *70 Ophiuchi*. The first known formal astrometric calculation for an extrasolar planet was made by W. S. Jacob in 1855 for this star. Similar calculations were repeated by others for another half-century[39] until finally refuted in the early 20th century.[40][41] For two centuries claims circulated of the discovery of *unseen companions* in orbit around nearby star systems that all were reportedly found using this method,[39] culminating in the prominent 1996 announcement of multiple planets orbiting the nearby star Lalande 21185 by George Gatewood.[42][43] None of these claims survived scrutiny by other astronomers, and the technique fell into disrepute.[44] Unfortunately, the changes in stellar position are so small and atmospheric and systematic distortions so large that even the best ground-based telescopes cannot produce precise enough measurements. All claims of a *planetary companion* of less than 0.1 solar mass, as the mass of the planet, made before 1996 using this method are likely spurious. In 2002, the Hubble Space Telescope did succeed in using astrometry to characterize a previously discovered planet around the star Gliese 876.[45]
- Future space-based observatories such as ESA's GAIA may succeed in uncovering new planets via astrometry, but for the time being no planet detected by astrometry has been confirmed.
- One potential advantage of the astrometric method is that it is most sensitive to planets with large orbits. This makes it complementary to other methods that are most sensitive to planets with small orbits. However, very long observation times will be required — years, and possibly decades, as planets far enough from their star to allow detection via astrometry also take a long time to complete an orbit.
- In 2009 the discovery of VB 10b by astrometry was announced. This planetary object was reported to have a mass 7 times that of Jupiter and orbiting the nearby low mass red dwarf star VB 10. If confirmed, this would be the first exoplanet discovered by astrometry of the many that have been claimed through the years.[46][47] However recent radial velocity independent studies rule out the existence of the claimed planet.[48] [49]
- **Eclipsing binary minima timing**
- When a double star system is aligned such that - from the Earth's point of view - the stars pass in front of each other in their orbits, the system is called an "eclipsing binary" star

system. The time of minimum light, when the star with the brighter surface area is at least partially obscured by the disc of the other star, is called the primary eclipse, and approximately half an orbit later, the secondary eclipse occurs when the brighter surface area star obscures some portion of the other star. These times of minimum light, or central eclipse, constitute a time stamp on the system, much like the pulses from a pulsar (except that rather than a flash, they are a dip in the brightness). If there is a planet in circum-binary orbit around the binary stars, the stars will be offset around a binary-planet center of mass. As the stars in the binary are displaced by the planet back and forth, the times of the eclipse minima will vary; they will be too late, on time, too early, on time, too late, etc.. The periodicity of this offset may be the most reliable way to detect extrasolar planets around close binary systems.[50][51][52]

- **Polarimetry**
- Main article: Polarimetry
- Light given off by a star is un-polarized, i.e. the direction of oscillation of the light wave is random. However, when the light is reflected off the atmosphere of a planet, the light waves interact with the molecules in the atmosphere and they are polarized.[53]
- By analyzing the polarization in the combined light of the planet and star (about one part in a million), these measurements can in principle be made with very high sensitivity, as polarimetry is not limited by the stability of the Earth's atmosphere.
- Astronomical devices used for polarimetry, called polarimeters, are capable of detecting the polarized light and rejecting the unpolarized beams (starlight). Groups such as ZIMPOL/CHEOPS[54] and PlanetPol[55] are currently using polarimeters to search for extra-solar planets, though no planets have yet been detected using this method.
- **Auroral radio emissions**
- Auroral radio emissions from giant planets with plasma sources such as Jupiter's volcanic moon Io could be detected with future radio telescopes such as LOFAR.[56][57]
- **Pulsation frequency**
- Some pulsating variable stars are regular enough that radial velocity could be determined purely photometrically from the Doppler shift of the pulsation frequency, without needing spectroscopy.[58][59]
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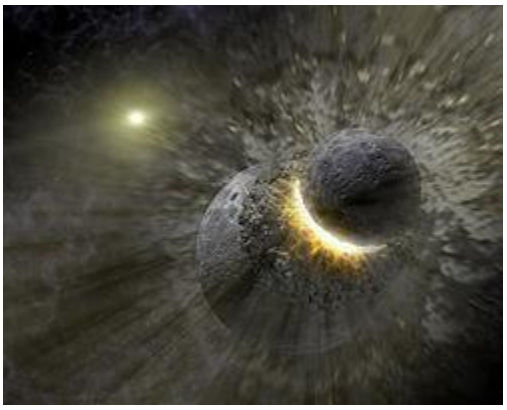
Detection of extrasolar asteroids and debris disks

- **Circumstellar disks**



- An artist's conception of two Pluto-sized dwarf planets in a collision around Vega.
- Disks of space dust (debris disks) surround many stars. The dust can be detected because it absorbs ordinary starlight and re-emits it as infrared radiation. Even if the dust particles have a total mass well less than that of Earth, they can still have a large enough total surface area that they outshine their parent star in infrared wavelengths.[60]
- The Hubble Space Telescope is capable of observing dust disks with its NICMOS (Near Infrared Camera and Multi-Object Spectrometer) instrument. Even better images have now been taken by its sister instrument, the Spitzer Space Telescope, and by the European Space Agency's Herschel Space Observatory, which can see far deeper into infrared wavelengths than the Hubble can. Dust disks have now been found around more than 15% of nearby sunlike stars.[61]
- The dust is believed to be generated by collisions among comets and asteroids. Radiation pressure from the star will push the dust particles away into interstellar space over a relatively short timescale. Therefore, the detection of dust indicates continual replenishment by new collisions, and provides strong indirect evidence of the presence of small bodies like comets and asteroids that orbit the parent star.[61] For example, the dust disk around the star tau Ceti indicates that that star has a population of objects analogous to our own Solar System's Kuiper Belt, but at least ten times thicker.[60]
- More speculatively, features in dust disks sometimes suggest the presence of full-sized planets. Some disks have a central cavity, meaning that they are really ring-shaped. The central cavity may be caused by a planet "clearing out" the dust inside its orbit. Other disks contain clumps that may be caused by the gravitational influence of a planet. Both these kinds of features are present in the dust disk around epsilon Eridani, hinting at the presence of a planet with an orbital radius of around 40 AU (in addition to the inner planet detected through the radial-velocity method).[62] These kinds of planet-disk interactions can be modeled numerically using collisional grooming techniques.[63]
- **Contamination of stellar atmospheres**
- Recent spectral analysis of white dwarfs' atmospheres by Spitzer Space Telescope found contamination of heavier elements like magnesium and calcium. These elements cannot originate from the stars' core and it is probable that the contamination comes from asteroids that got too close (within the Roche limit) to these stars by gravitational

interaction with larger planets and were torn apart by star's tidal forces. Spitzer data suggests that 1-3% of the white dwarfs has similar contamination.[64]

PART 6: LINKS / REFERENCE NOTES…

1 http://www.ips.gov.au/IPSHosted/neo/index.html
Project Wormwood ..Learmonth Solar Observatory

2 http://www.youtube.com/watch?v=1fzIL6TuOy0&feature=related

James McCanney 7/19/2012 Planet X and Dead Scientists

3 http://www.lib.kobe-u.ac.jp/repository/90001430.pdf

Japanese Kobe University paper on Brown Dwarfs

4 http://en.wikipedia.org/wiki/South_Pole_Telescope
South pole telescope information

PART 7 : TIPS AND FACTS…

A massive planet, still unknown to the modern astronomy, produces the perturbations which Lowell found for Uranus and those Pickering found for Neptune. We can tell it with mathematical certainty since 1978, when the astronomer James Christie (US Naval Observatory) discovered the satellite Charon and in consequence determined the mass of the Pluto-Charon system. So a huge planet remains to be found.

The Vatican telescope at Mt hood in Untied States of America

Maybe LUCIFER is an acronym for:
Large Binocular Telescope Near-infrared
Utility with
Camera and
Integral
Field Unit for
Extragalactic
Research

Although no 'official' confirmation of Nibiru's existence has been announced–as of January of 2005, NASA does claim to be tracking a newly discovered 'dwarf-planet' beyond Pluto that has been named 'Eris' after the Greek Goddess of 'strife'. Her companion moon is named 'Dysnomia'–also Greek for 'lawless'. It should be noted, however, that Eris gives off a suspicious red glow quite like that attributed to Nibiru. Also, vast sums of money are being spent by American, European and Japanese space agencies to launch a fleet of solar observatories to monitor the increase of solar flares coming from our sun.

In 2003 the Spitzer Space Telescope was launched as the world's largest orbiting infrared telescope. And in addition we now have 'SOFIA'–NASA's Stratospheric Observatory For Infrared Astronomy–high altitude jumbo jets fitted with onboard telescopes for astronomical study.

The South Pole Telescope (SPT) is a 10 meter diameter telescope located at the Amundsen-Scott South Pole Station, Antarctica. It is a microwave/millimeter-wave telescope that observes in a frequency range between 70 and 300 GHz. The primary science goal for SPT is to conduct a survey to find several thousand clusters of galaxies, which should allow interesting constraints on the Dark Energy equation of state.

'Henry Deacon', (Not his real name), an ex Livermore scientist, a secretive, high-level

department within the National Oceanic and Atmospheric Administration (NOAA) is not only aware of the fact that we live in a binary star system, they know where the twin is, and how it is perturbing our Sun because, they're already factoring these perturbations into their forecasts.

A research group at Japan's Kobe University has concluded that their research indicates the possible existence of another solar system planet beyond Neptune.

According to the research conducted by Mukai and Patryk Lykawka, the planet is about 30-70 percent of Earth's mass and tilts about 20-40 degrees to the plane of orbit and circles the sun in an elliptical orbit every thousand years.

Dr Rodney Marks, a brilliant young astrophysicist who died in 2000 .He worked for a program for the Smithsonian called AST/RO (Antarctic Submillimeter Telescope and Remote Observatory) and spent most of his time collecting data on how to further improve viewing conditions using an enormous infrared telescope. His work was highly regarded, and he was making profound breakthroughs in the way we view the cosmos from Earth. His employers where Raytheon Polar Services, a Colorado-based division of the defense contractor Raytheon Corporation -- a high-tech firm that is deeply involved in a variety of black-ops programs for the U.S. government all around the world.

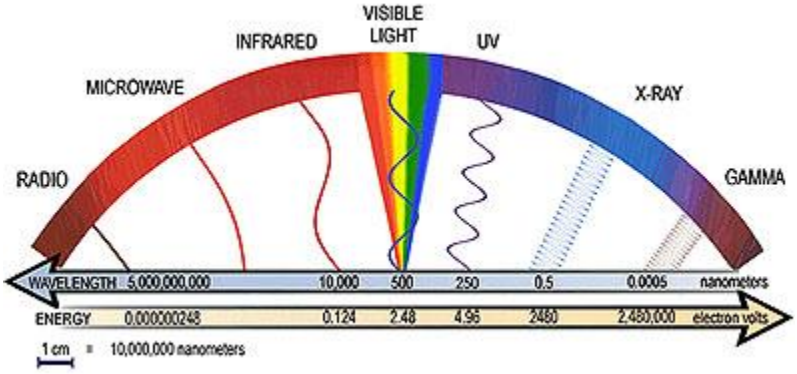
NASA Press Release 1992

"Unexplained deviations in the orbits of Uranus and Neptune point to a large outer solar system body of 4 to 8 Earth's mass, on a highly tilted orbit, beyond 7 billion miles from the sun."
This NASA press release was thankfully documented in a 1992 video by, Zecharia Sitchin revealing an excerpt from the 1992 NASA press release!

"Would like to commend Dana Rohrbacher (R CA) for introducing to Congress HR 4917, the NEO Preparedness Act, which if passed would establish an Office of Potentially Hazardous Near-Earth Object Preparedness. As Congressman Rohrbacher has acknowledged, NEOs range in size from small dust particles to near planet sized behemoths. As Planet X approaches our galaxy, its gravitational pull will interact with these NEOs in potentially disastrous ways for our planet. Read the congressmans Press Release on his website here :

http://rohrabacher.house.gov/News/DocumentSingle.aspx?DocumentID=98633

Chandra Images & False Color



Light SpectrumImages taken by telescopes that observe at the "invisible" wavelengths are sometimes called "false color images." That is because the colors used to make them are not "real" but are chosen to bring out important details.

The color choice is usually a matter of personal taste, and is used as a type of code in which the colors can be associated with the intensity or brightness of the radiation from different regions of the image, or with the energy of the emission.

Robert S. Harrington - at the time head of the Naval Observatory, Washington DC. Was head of NASA Planet X internal study and was on his final trip to New Zealand to photograph Planet X. He died suddenly of the same rapid-onset type of cancer that Chuck Schramek died from.

Gene Schumacher - NASA planetary geologist while studying ancient asteroid impacts in Australia.

He was a prolific discoverer of comets and we all know now that NASA is lying about the fact that they know I [McCanney] am right and have been right for over 25 years - that comets are not dirty snowballs, but are a complex plasma discharge phenomena, and with the larger ones becoming planets and moons of the solar system.

Schumacher had access to the southern hemisphere data, as did Harrington. He could see the vast comet Hale-Bopp and knew, as did NASA at that time, of the original discovery of Hale-Bopp, which must have been in the same time that Harrington was viewing Planet X, that Hale-Bopp AT THAT TIME was on a near direct collision course with Earth (it later fell behind schedule due to the tail drag and missed us by nearly 3 months).

But the point is that Schumacher must have known this and was going to go public to spill the beans on all of this. Like Harrington, he was well known and would have carried many scientists with him.

The story of his “death” is the most ridiculous lie you would ever hear. There was no autopsy, and there is no information available other than there was a jeep crash and he died on the way to the hospital.

His ashes were blasted into outer space, out of a NASA satellite, as a "tribute".

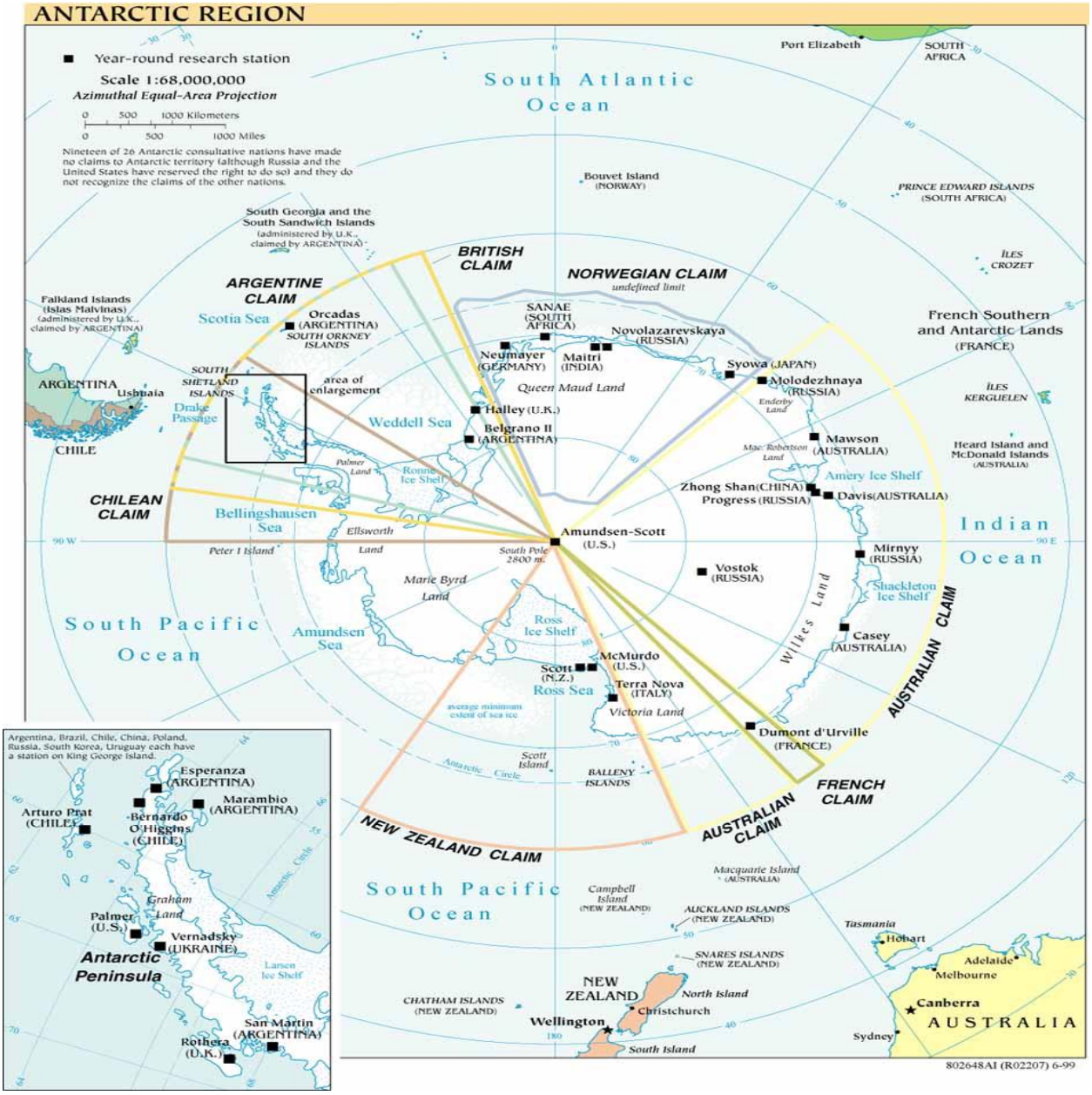
In November 1996 amateur astronomer Chuck Shramek of Houston, Texas took a CCD image of the comet, which showed a fuzzy, slightly elongated object nearby. When his computer sky-viewing program did not identify the star, Shramek called the Art Bell radio program Coast to Coast AM to announce that he had discovered a "Saturn-like object" following Hale–Bopp. UFO enthusiasts, such as remote viewing proponent Courtney Brown, soon concluded that there was an alien spacecraft following the comet.[51] Several astronomers, including Alan Hale,[52] claimed the object was simply an 8.5-magnitude star, SAO141894, which did not appear on Shramek's computer program because the user preferences were set incorrectly.[53] Later, Art Bell even claimed to have obtained an image of the object from an anonymous astrophysicist who was about to confirm its discovery. However, astronomers Olivier Hainaut and David J. Tholen of the University of Hawaii stated that the alleged photo was an altered copy of one of their own comet images.

So my conclusion is that we experience catastrophe approximately every 4200 years (2 x 2,148 = 4200) and 3 times within a processionals time scale of 25,776 years. Mayan Elder, Hunbatz Men, also revealed that the Mayans have known about Tzoltze ek' (Nibiru) for many years. They say "The planet has a period of 6,500 years, not 3,600, and visits us 4 times every 26,000 year processionals cycle" (Platonic Year or Great Year, that ends on 21st December 2012). If we go back 6,444 years (3 x 2,148) from 2012 AD, then it brings us to 4,432 BC, when the Antarctic ice cap formed.

There is much controversy over the dating of the Biblical Flood, but if we look at archaeological data for 10,983 BC and 4,432 BC, we see evidence of major flooding and catastrophic climate change. There is also evidence of a flood around 2,200 BC, leading bible scholars to conclude this was the Biblical Flood. But I suggest this flood was much more localized than the great flood, due to the passage of Nibiru at a reasonably safe distance.

Sooooo... Just a coincidence that these other cultures have a 2012 target?

- **Hopi** Predict a 25yr period of purification followed by End of Fourth World and beginning of the Fifth.
- **Mayans** Call it the 'end days' or the end of time as we know it.
- **Maoris** Say that as the veils dissolve there will be a merging of the physical & spiritual worlds.
- **Zulu** Believe that the whole world will be turned upside down.
- **Hindus** Kali Yuga (end time of man). The Coming of Kalki & critical mass of Enlightened Ones.
- **Incas** Call it the 'Age of Meeting Ourselves Again'.
- **Aztec** Call this the Time of the Sixth Sun. A time of transformation. Creation of new race.
- **Dogon** Say that the spaceship of the visitors, the Nommo, will return in the form of a blue star
- **Pueblo** Acknowledge it'll be the emergence into the Fifth World
- **Cherokee** Their ancient calendar ends exactly at 2012 as does the Mayan calendar.
- **Tibetan** Kalachakra teachings are prophesies left by Buddha predicting Coming of the Golden Age.
- **Egypt** According to the Great Pyramid (stone calendar), present time cycle ends in year 2012 AD


ANTARCTIC REGION
Year-round research station
Scale 1:68,000,000
Azimuthal Equal-Area Projection
0 500 1000 Kilometers
0 500 1000 Miles
Nineteen of 26 Antarctic consultative nations have made no claims to Antarctic territory (although Russia and the United States have reserved the right to do so) and they do not recognize the claims of the other nations.
South Atlantic Ocean
South Pacific Ocean
Indian Ocean
Port Elizabeth
SOUTH AFRICA
Bouvet Island (NORWAY)
PRINCE EDWARD ISLANDS (SOUTH AFRICA)
ÎLES CROZET
South Georgia and the South Sandwich Islands (administered by U.K., claimed by ARGENTINA)
BRITISH CLAIM
NORWEGIAN CLAIM
undefined limit
ARGENTINE CLAIM
Falkland Islands (Islas Malvinas) (administered by U.K., claimed by ARGENTINA)
Scotia Sea
Orcadas (ARGENTINA)
SOUTH ORKNEY ISLANDS
SANAE (SOUTH AFRICA)
Novolazarevskaya (RUSSIA)
French Southern and Antarctic Lands (FRANCE)
Neumayer (GERMANY)
Maitri (INDIA)
Syowa (JAPAN)
Molodezhnaya (RUSSIA)
ARGENTINA
Ushuaia
SOUTH SHETLAND ISLANDS
area of enlargement
Queen Maud Land
Enderby Land
ÎLES KERGUELEN
Drake Passage
Halley (U.K.)
Weddell Sea
Belgrano II (ARGENTINA)
Mawson (AUSTRALIA)
Mac. Robertson Land
Heard Island and McDonald Islands (AUSTRALIA)
CHILE
Palmer Land
Ronne Ice Shelf
Amery Ice Shelf
Zhong Shan (CHINA)
Progress (RUSSIA)
Davis (AUSTRALIA)
CHILEAN CLAIM
Bellingshausen Sea
Ellsworth Land
Amundsen-Scott (U.S.)
Peter I Island
South Pole 2800 m.
Mirnyy (RUSSIA)
Vostok (RUSSIA)
Marie Byrd Land
Shackleton Ice Shelf
Wilkes Land
AUSTRALIAN CLAIM
Amundsen Sea
Ross Ice Shelf
Casey (AUSTRALIA)
McMurdo (U.S.)
Scott (N.Z.)
Terra Nova (ITALY)
Ross Sea
Victoria Land
average minimum extent of sea ice
Dumont d'Urville (FRANCE)
Scott Island
Antarctic Circle
BALLENY ISLANDS
FRENCH CLAIM
AUSTRALIAN CLAIM
NEW ZEALAND CLAIM
Macquarie Island (AUSTRALIA)
Campbell Island (NEW ZEALAND)
AUCKLAND ISLANDS (NEW ZEALAND)
Tasmania
Hobart
SNARES ISLANDS (NEW ZEALAND)
Adelaide
Melbourne
NEW ZEALAND
North Island
CHATHAM ISLANDS (NEW ZEALAND)
Christchurch
Canberra
AUSTRALIA
Wellington
Sydney
South Island
Argentina, Brazil, Chile, China, Poland, Russia, South Korea, Uruguay each have a station on King George Island.
Esperanza (ARGENTINA)
Marambio (ARGENTINA)
Arturo Prat (CHILE)
Bernardo O'Higgins (CHILE)
Graham Land
Palmer (U.S.)
Vernadsky (UKRAINE)
Antarctic Peninsula
Larsen Ice Shelf
San Martin (ARGENTINA)
Rothera (U.K.)
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