



# First Light

The Newsletter of the Cape Cod Astronomical Society



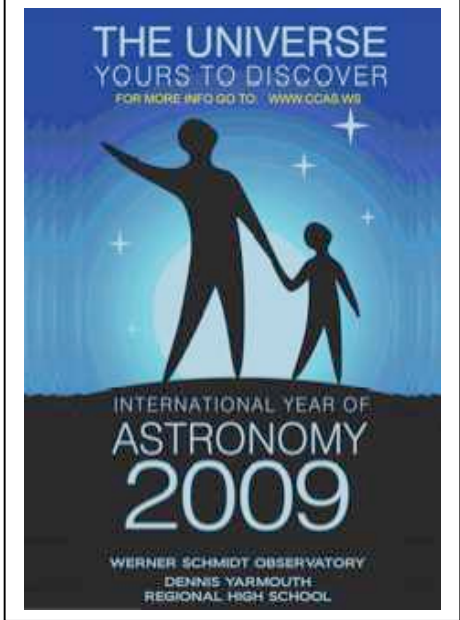
**January, 2009** **Vol.20 No. 1**

The Executive Board has begun planning CCAS activities for the International Year of Astronomy: 2009. Copies of the Poster shown here will be made available soon to all members.

Next CCAS General Meeting:  
(NOT New Years Day!) Thursday January 8<sup>th</sup>  
at 7:30PM; D-Y Library.  
Find out how ancient peoples navigated by the sun and the stars. More on the program on page 2.

Next Public "Dark Saturday" Star Party:  
(None in December) January 24<sup>th</sup>, 2009

Next Executive Board Meeting:  
(None in December) January 20<sup>th</sup>, 2009



## Bright New Stars:

We welcome to our membership Jack Murphy of Eastham, and Cathie Richardson of Hyannisport. Also please note that our welcome to Dakota DeSmet last month is not a welcome; it is a welcome back!

As always, we invite recently joined members to send an email to the [info@ccas.ws](mailto:info@ccas.ws) email address letting us know a little more about themselves: background, astro equipment preferred if any, and interests.

## Thoughts on First Light

Thanks to Tom Leach for spearheading design of the CCAS version of the international YoA poster, for finding Mike Farber and making CCAS "partners" of a sort in the "Cornerstone" Project (see page 4,) and to Chris Cook for sending us his spectacular photo of the Dec 1<sup>st</sup> conjunction.

Thank you, members!  
"First Light wants YOU!"

## CCAS Events

Thanks to Mike Farber for his most interesting and compelling presentation on the "Cornerstone" project. Much more on that subject on page 4.

Highlights of the 12/4/08 CCAS Business Meeting from our Secretary Stan Rivers:

There were 18 members and 12 guests in attendance at our meeting on December 4. The membership unanimously approved Stan Rivers as our new Secretary. Mike Hunter gave us background on the radio interview he conducted about CCAS which was aired Wednesday, 12/4, on 99.9FM and 104.7FM. Tom Leach discussed progress on creating a CCAS customized version of the 2009 International Year of Astronomy (IYA) poster for CCAS promotions. A motion was approved to spend circa \$150 to print 500 copies of the poster. Tom also announced he will host off-site Observing Nights for members of the Harwich Conservation Trust on December 10, 2008 and January 8, 2009. Other items in the

minutes: Peter Birren's Observer's Guide, and the status of our Meade 16" telescope are covered later in this FL.

Dr. John Huth will speak on Primitive Navigation at our next meeting on January 8<sup>th</sup>. Among others, the Vikings and the Polynesians used the stars for navigation. Because the latitudes of voyaging for these two cultures differed substantially, their navigation techniques had significant differences. For example: the Polynesians created a "sidereal compass" that takes advantage of the fact that stars always rise and set at the same azimuth over the course of the year. The Vikings, on the other hand, voyaged mostly during the summer months and were much more dependent on the sun, which has its own special set of problems to be solved.

Dr. Huth will describe a number of techniques used for navigation by ancient cultures. He will then jump to some "homespun" techniques we can use in modern times such as navigating using a wristwatch. John is a Donner Professor of Science and teaches in the Faculty of Arts and Sciences at Harvard University.

Thanks to Tom Leach, our Programs Director, for the good work he does to bring us informative speakers and topics; please be sure to contact Tom if you have ideas for upcoming speakers or programs; don't forget yourself!

On February 5<sup>th</sup>, Observatory Director Mike Hunter will speak on the construction and modification of telescopes: from the smallest 3" telescope he made in 1957 to a micro-observatory for an 8" Schmidt-Newtonian and beyond. This will be the first of a two part series from Mike on the construction and maintenance of telescopes.

On March 5<sup>th</sup>, Mike will return to speak on telescope maintenance. As telescopes become more accurate, powerful, and complex, they become more susceptible to problems and more in need of proper maintenance. Mike will bring everyone up to speed on scope maintenance and alignment of the spectrum of telescopes from even the smallest Dobsonian to a permanently mounted computer-controlled 16" scope. Not to be taken lightly, maintenance is one of the single, most important things that can be done by the amateur astronomer to optimize viewing pleasure.

### **"Dark Saturdays": Winter Star Parties**

One Star Party is scheduled each month at 7:30pm at the Werner Schmidt observatory. The target date is set as the Saturday evening closest to the timing of the New Moon.

There will be no "Dark Saturday" Star Party in December. The "Dark Saturday" event beginning 2009 will take place on January 24<sup>th</sup>.

### **Outreach to Students**

Once again we had to cancel sessions for students at the Observatory during December: one session for students from 4C's and two for the newly formed Dennis-Yarmouth High School Astronomy Club.

In January we are going to try a new paradigm for planning Star Parties: rather than schedule dates for the Dome and then hope for good weather, we are going to start with forecasts for clear weather and scramble to schedule guests and staff. Maybe that will work best in the winter season.

Any members wishing to become involved in these initiatives please contact Peter Kurtz.

### **Executive Corner**

There was no Board meeting in December. The next meeting of the Board will be January 20<sup>th</sup> in Snow Library.

### **From the Dome**

After many washouts in November, there were high hopes for accomplishing both student and open Star Parties in December.

However, on December 1, 3, and 7, Foundation and Observatory Staff experienced critical mechanical and software failures when aligning the 16" scope. These failures had been encountered in the past but not as severe or frequent. With the extended warranty for the scope lapsing next August, the Meade company in a severe financial situation, and a typically slow winter observing season, the decision to ship the scope and mount back to Meade for repair was finalized. The scope was taken off line on Friday, December 12. It is expected that the scope will be back on line by approximately the first of March. Until that time, observing will continue with the 18" and 8".

**As always, "Private" group or individual observing sessions at the Werner Schmidt Observatory may be scheduled by contacting observatory Director Mike Hunter at [mamhunter@yahoo.com](mailto:mamhunter@yahoo.com).**

### **Foundation News...**

...when we have input from the Foundation...

**Reminder: CCAS has both 8" and 14" Dobsonian telescopes for loan to members. Currently, Rich Kosinski has the 14" at his home for observing and Bernie Young has the 8". If you wish to borrow one of these 'scopes, contact your editor at [info@ccas.ws](mailto:info@ccas.ws)**

## January Observing:

### Mooncusser's Almanac and Monthly Alert <sup>1</sup>

By Peter Kurtz

**JANUARY, 2009**

Object	Jan 01 (EST)	Jan 15 (EST)	Jan 31 (EST)
<b>Sun</b>	R: 07:07 S: 16:21	07:05 16:35	06:53 16:55
<b>Moon</b>	R: 09:54 S: 21:13	21:47 09:32	09:05 22:19
<b>Mercury</b> (pm then am)	R: 08:24 S: 17:48	07:30 17:33	05:35 15:21
<b>Venus</b> (evening)	R: 09:43 S: 20:12	09:18 20:35	08:40 20:52
<b>Mars</b> (-----am)	R: 06:41 S: 15:43	06:30 15:37	06:11 15:34
<b>Jupiter</b> (pm-----)	R: 08:14 S: 17:45	07:30 17:06	06:39 16:23
<b>Saturn</b> (pre-dawn)	R: 22:05 S: 10:49	21:09 09:54	20:03 08:50
<b>Uranus</b> (evening)	R: 10:30 S: 22:02	09:36 21:09	08:34 20:10
<b>Neptune</b> (early eve)	R: 09:23 S: 19:45	08:29 18:52	07:27 17:52
<b>Pluto</b> (pre-dawn)	R: 06:02 S: 15:58	05:09 15:04	04:08 14:03

### Moon Phases, January, 2009

**First QTR** Sunday, January 4<sup>th</sup> at 4:56am EST

**Full Moon** Saturday, January 10<sup>th</sup> at 10:27pm EST

**The Full Moon is the "largest" of the year.  
On this date, the moon reaches the 2<sup>nd</sup> closest perigee of the year. Thus, once again, large tide magnitudes.**

**Last QTR** Saturday, January 17<sup>th</sup> at 9:46pm EST

**New Moon** Monday, January 26<sup>th</sup> at 2:55am EST

### More on January Observing

The Quadrantid meteor shower peaks at 8am on January 3<sup>rd</sup>. This is usually a fairly intense shower for four hours or so about the peak. If you are not greedy, there should be satisfying quantities of meteors for about five days centered on the peak so don't limit looking to just early morning on the 8<sup>th</sup>. This shower is named after the now defunct constellation *quadrans muralis* which was named to honor the role of the quadrant in navigation. The radiant is located at a point southeast of the end of the

handle of the big dipper and northeast of the head of the "fish" shape of the constellation Bootes.

**Planets:** Not all that much to see in January in early evening. **Neptune** and **Uranus** are reasonable targets; **Venus** is higher and higher in the sky after sunset each evening: up to 32° altitude in the southwest on New Years Day; 40° altitude on January 31. **Venus** will be only 1° separated from **Uranus** on Friday, January 23; centering a telescope on **Venus** and then looking to find **Uranus** "without a computer" should make for a rewarding observing exercise. **Venus** will make another nice pairing on January 30<sup>th</sup> this time just 3° south of the **crescent moon** just above the horizon; this, a reprise of the wonderful moon/Jupiter/Venus conjunction observed on December 1<sup>st</sup> (see page 4)... without Jupiter!

The asteroid **Vesta**, brightest of the large asteroids (albeit only 2<sup>nd</sup> largest, mean diameter 530km, after the largest, Ceres) continues to be located conveniently for telescope observation in January. From the point pictured for 1/1/09 in the path chart published in last month's First Light (RA 2 3' 27"; Dec 5 7' 11", 5° NNE of α-Piscis) it moves by month's end only to RA 2 23' 8"; Dec 8 40' 41", 1.25° SW of ξ(xi2)-Ceti.

Check daily finder charts at [www.heavens-above.com](http://www.heavens-above.com) if you wish to look for Vesta on any particular evening.

### Libration and Declination Tables for the Moon <sup>2</sup>

JANUARY	
Max Longitudinal	Min Longitudinal
1/16 (7.4°)	1/4 (-7.7°)
Max Latitudinal	Min Latitudinal
1/19 (6.9°)	1/6 (-6.7°)
Max Declination	Min Declination
1/9 (27.1°)	1/22 (-27.1°)

### Minima of Algol visible after dark at Cape Cod: <sup>1,3</sup>

[Only minima actually timed near or after sunset thru predawn at Cape Cod are noted.]

JANUARY	
4:18am	Thursday, Jan 8
2:08am	Sunday, Jan 11
9:57pm	Tuesday, Jan 13
6:46pm	Friday, Jan 16

## Items of Interest in Recent Astronomy News:

From time to time news items appear in current Astronomy media that are of special interest or significance. When this occurs, First Light will feature alerts to or short overviews of such news.

**Good News:** NASA<sup>4</sup> announced on December 4th that space shuttle Atlantis STS-125's mission to repair the Hubble Space Telescope is targeted to launch May 12,

2009. The mission, which was previously scheduled for October of this year, was delayed when a data handling unit on the telescope failed. Since then, engineers have been working to prepare a 1970's era spare unit for flight. They expect to be able to ship the spare, known as the Science Instrument Command and Data Handling System, to NASA's Kennedy Space Center in Florida in spring 2009. Given the money crunch these days, it wasn't all that far fetched to think the mission might have been cancelled.

### "Christmas Tree" Ornament from Hubble

Almost as if to celebrate the Season and for sure to celebrate the announcement about the shuttle repair mission, this image is one of the latest views from the Hubble Space Telescope, closely resembling a toy snow globe. In this case, *over a hundred thousand glittering stars* are the little faux snow flakes and the cluster's globular structure is the glass globe. The cluster of interest is **M13**, located in Hercules over 25,000 light years away. It measures 150 light years across; that's 0.15% of the diameter of our galaxy! Although very pretty (and very festive), there are some interesting things going on inside this little cluster of stars. See <http://www.universetoday.com/2008/12/08/hubbles-early-festivities-imaging-the-m13-globular-cluster-snow-globe/>



## December 5, 2008: CCAS Participates in the "Cornerstone" Project

Participants in our December 4<sup>th</sup> Society meeting were privileged to hear a most informative and amazing presentation on how Mike Farber, a local lawyer and historian, and coworkers conduct field work to locate stone markers, "Cornerstones", to verify a theory on how Cape town boundary lines were set 400 years ago. The day after our meeting, Mike and his colleagues, including our own Tom Leach, ventured into the bog to view a key stone. This an extract of writeups of that venture by Tom Leach and also of an article that appeared in the Cape Cod Times.

A theory was developed some years ago by historian Morse Payne. Payne theorized that many original town boundary lines fall on certain of the 32 point compass points based on a magnetic north-south compass line that runs from Woods End at Provincetown through an as yet unbound centerpoint in Cape Cod Bay to and through a point at Quivett Creek in Dennis. Among other town boundaries lying on compass points radiating from the centerpoint in Cape Cod Bay is the Truro-Wellfleet boundary line which lies perpendicular to the magnetic north-south line. Other research has verified that in 1639, the magnetic North-South line lay 13° west of the celestial or "True" North; today that "compass variation" at the outer Cape is some 16°.

Following information from a Yarmouth legend that there is an ancient stone marker beside Mill Pond in Cummaquid, Mike Farber's assistant, one Justin Lojko, who was also present at our December 4<sup>th</sup> meeting, recently found the legendary stone north of Anthony's Cummaquid restaurant. This stone lies on the compass point two "points" (22.5°) west of the north-south line mentioned above. This stone lies on the Barnstable/Yarmouth borderline.

CCAS Vice President and Program Chairman Tom Leach was invited to join Farber and a small group including journalist Robin Lord from the Cape Cod Times to view that stone on December 5<sup>th</sup>, the day after our December meeting. Lord reviews the groups' trek to see the stone in an article on page 3 of the main section of the CCT dated Monday, December 8<sup>th</sup>.



The stone lies right where it should be, bears an engraved B(lower arrow) and Y and also a cross aligned to the magnetic north-south compass line as it existed in 1639.

This stone and other “cornerstones” found by Farber and colleagues are markers left by the Pilgrims 400 years ago likely a good deal more authentic than the vaunted “Plymouth Rock” located in Plymouth, MA visited by thousands of tourists each year.



Tom, also webmaster for the CCAS website, was so enthused over his experience viewing the stone at Cummaquid that he has created a special webpage on our website called the “MorsePayneProject” page. Go to <http://www.ccas.ws/morsepayneproject.html> or go to the Home Page of our CCAS website, scroll down and click on the picture of Mike Farber in a CCAS cap (just to the right of the article entitled, “Marvelling at the Night Sky.”

The “Morse Payne Project” page contains a wonderful summary of the entire story including pictures from the visit to the rock at Cummaquid on December 5<sup>th</sup> and, at the bottom, some excellent reference sources; in particular, the article "The Ordering of Towns", H. Morse Payne, New England Antiquities Research Association 2000, and "The Survey of the Old Colony", H. Morse Payne, 1985. Both articles, URL's available at the CCAS website, fill out background information.

Many thanks to Mike Farber and his colleagues for the great work they have done and are doing and for a very special talk to

our group. And many thanks to Tom Leach, our Program Chairman, for “finding” this great story and speaker and spearheading CCAS continued involvement in the project.

One further note: At our December 4<sup>th</sup> meeting after Mike Farber’s talk, Hilda Whyte spoke a moment or two about CCAS logos past and present and offered a blue cap bearing our current logo (as on the first page of First Light) to anyone who might want it. Mike Farber said he would be pleased to have the cap. The article in the Cape Cod Times published on December 8<sup>th</sup> shows Mr. Farber wearing our cap with our logo (arrow)!

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## Cape Clime

Tom Leach found the following clip in a recent *Cape Codder* which maybe explains why so many recent Star Parties had to be cancelled:

“If you delight in perfect skies/ A sun that daily seems to rise,/ Sweet days of seasonal delights/ Sparkling, cloudless, star-lit nights/ if such a clime excites you dear, then why on earth did you move here?” ..... Ben Thatcher



**Tools for Observers:** Some of you know your editor has been playing “pitch man” for a little Observing Guide called “Objects in The Heavens” by one Peter Birren. A copy was circulated at the December CCAS meeting. Not only observers new and experienced, but any teacher of Astronomy will enjoy having a copy of this little book to lead observing sessions and also in some cases to recommend copies to his students. Please click on the URL just below for an overview of the book, samples of inside pages, reviews, and, if you wish, how to order copies directly from Peter Birren’s website. If you look carefully at the website you will also see that you can download *free copies* in PDF format. But the plastic covers, “sits flat” coil binding, and sturdy pages are critical, in my view, when using the book at the ‘scope; so order a copy.

<http://www.birrendesign.com/astro.html>

We discovered this book when the author sent a “Would you be interested?” note to our email address: [info@ccas.ws](mailto:info@ccas.ws)

## CCAS ASTROPHOTO OF THE WEEK

Many of our members and friends thoroughly enjoyed the exquisite conjunction of a 4 day old 15%-lit crescent moon, Jupiter, and Venus at and after dusk on the first day of December. Several members sent in super photos of the event. As we have learned to expect, one very special photo was made available to us by Chris Cook, CCAS member and professional photographer.



If you look very closely, you can see at least two of the moons of Jupiter oriented 10 o'clock to 4 o'clock about the planet. If you can't see those moons, and want to, please contact your editor and I can send you a "more pixels" version or contact Chris directly. Tom Leach may also have a version on our website.

...shot with a Canon EOS 5D with Canon 70-200 f/2.8L lens mounted on a Manfrotto tripod; exposure f5.6, 1.6 sec @ ISO 800; Adobe Photoshop CS3 Processing; taken at Chris' Harwich Imaging Station.

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**A PORTION OF THIS PAGE IS INTENTIONALLY LEFT BLANK TO REMIND  
ALL MEMBERS THAT THERE IS ALWAYS PLENTY OF ROOM IN FIRST  
LIGHT FOR YOUR CONTRIBUTIONS.**

.....A Project Idea?

.....A Photo?

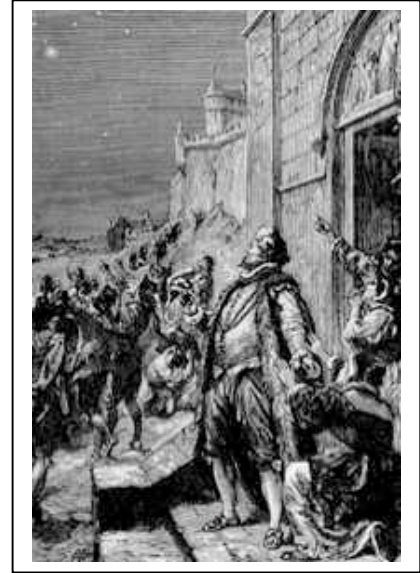
.....A Piece of Club History?

.....A Short Profile on Yourself: New or Old Members!?

## Light Echos from the Explosion Tycho Brahe Saw in the Sky in 1572 Arrive at Earth and Tell “The Rest of the Story” about His Supernova

Many of you may have seen the Associated Press story in the Cape Cod Times on Dec 4th summarizing an article published in *Nature* on the same date about a wave of “echo” light arriving here in 2008. The light comes from the same area of sky where Tycho Brahe saw a (now confirmed to be Type Ia) supernova in 1572. In recent days there have been multiple online writeups of this very important story. Some treatments focus on the mechanism of the “light echo” event and some speak to the new understanding of this supernova which Tycho saw 436 years ago. The purpose here is to extract highlight points and provide key references in the hope that all of our readership can delve deeper into the substance and ramifications of this story.

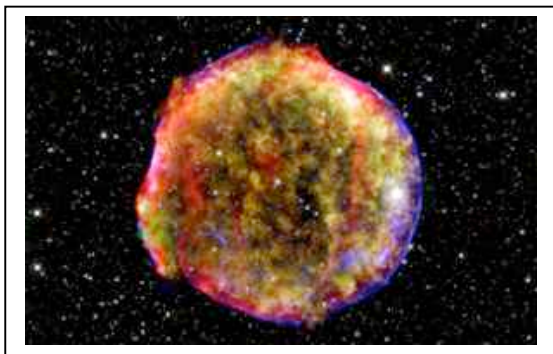
On November 11, 1572 Danish astronomer Tycho Brahe and other skywatchers observed what they thought was a new star. A bright object, magnitude -4, appeared in the constellation Cassiopeia, outshining even Venus, and it stayed there for several months until it faded from view. What Brahe actually saw was a supernova, a rare event where the violent death of a star sends out an extremely bright outburst of light and energy. This experience so impacted Brahe that he committed the rest of his life to pushing back the frontiers of astronomy. The event is also significant in that Brahe’s study and writing on the subject provided the first clear scientific evidence contradicting a philosophical view held since Aristotle: that the heavens beyond the sun and the planets are immutable.



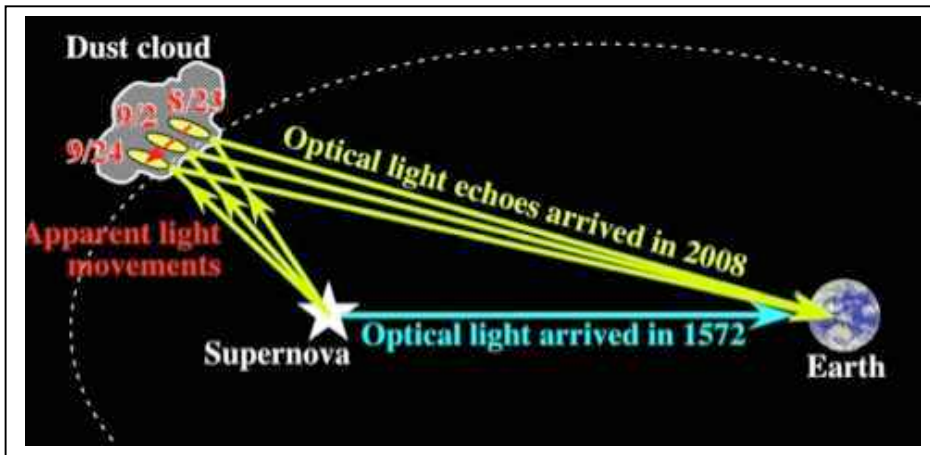
An engraving from the history “Astronomie Populaire” by Camille Flammarion (Paris, 1884)

The remains of this event can still be seen today as Tycho’s supernova *remnant*. The publication by scientists at the Max Planck Institute and other institutions which appeared in the December 4<sup>th</sup> issue of the journal *Nature*<sup>5</sup> sheds new light on “Tycho’s Supernova”, clearly marks it as a Type Ia event, and provides most interesting information about the current state of debris left over from the supernova event.

In 1572, the bright light from an event that had taken place ~7500 LY away arrived in the eyes of Tycho Brahe. What he was seeing was the very bright light emanating from the Type Ia supernova explosion itself. The magnitude -4 light was visible in broad daylight for some *two weeks*. The Max Planck scientists and their colleagues have now studied light “come lately” from that event; i.e., light arrived here 436 years later. This “latter” light is light from the explosion off the remnants from the explosion. Because it has had to travel farther (reflected off the debris) it arrives later than the original event by 436 years.



This composite image of the remnant combines infrared and X-ray data obtained with the Spitzer and Chandra space observatories and the Calar Alto observatory (operated by the Max Planck Institute in Andalucia in southern Spain). It shows the scene more than 400 years after the original explosion which Tycho and his contemporaries called “Stella Nova”. The thermonuclear explosion of the white dwarf star caused by accretion of a nearby (and still existing) donor star named Tycho G has left a several million degree hot cloud of expanding debris (green and yellow.) The remnant is expanding at a velocity of 9000km/s. The blast’s outer shock wave appears as a blue sphere of ultra high energy electrons. Newly synthesized dust from the circumstellar region of the supernova show at red wavelengths.

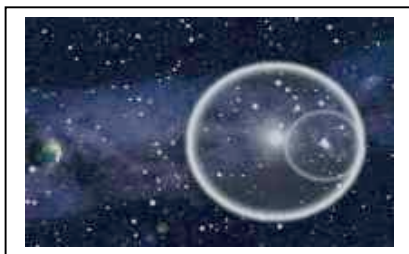


The original blast light reached earth in 1572. The “Light echo” off the remnants arrived 436 years later in 2008. As shown in this image<sup>6</sup> the light reflected from the remnants arrived here “late” because it had farther to travel.

BBC online gives two wonderful animations: the first,<sup>7</sup> the supernova blast and remnant forming process; and a second<sup>8</sup> which animates the arrival of the second wave of light 436 years after the first.

The first animation shows the blast itself and the growing remnant cloud. The time sequence culminates in the image of the remnant shown on page 7. Following the titanic thermonuclear blast, material is ejected into interstellar space at an incredibly high velocity - up to 30,000 kilometres per second (19,000 miles per second). Over the last four centuries, the debris have expanded to a diameter of more than 20 light years.

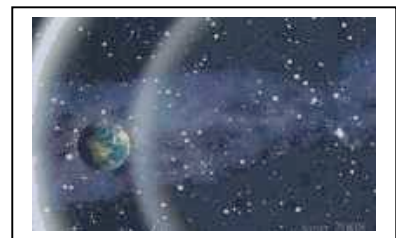
The second animation shows the light waves moving over the “7936” light years. Here are three images from that animation:



Light wave from Blast; 2° is Later



Blast Light hits Earth after ~7500LY 432 Years Later: Remnant Light Arrives



Obviously, the distance between the first and second light waves in this animation is greatly exaggerated; in truth, if the whole animation covers ~7936 LY you wouldn’t be able to distinguish the 436 year “late” wave from the main wave on this scale. But the concept of one wave of light which was so bright that Tycho could see it in daylight followed by the weaker echo light wave 436 years later seen in our fancy survey telescopes is nicely illustrated in this simulation.

Type Ia Supernova: Spectroscopic analysis of the light from the remnants proves that the supernova event was Type Ia; i.e., the explosion was triggered by a white dwarf accreting matter from a nearby donor star until compression caused the thermonuclear explosion which ended the existence of the white dwarf. This study showing SN1572 to be Type Ia confirms it at the first known Type Ia supernova to have taken place in the Milky Way galaxy. This finding is significant because Type Ia supernovae are the primary source of heavy elements in the universe; without them the universe would be mostly gas and not have the building blocks able to support life as we know it.

Tycho G: the accretion star: A star “nearby” in our galaxy named “Tycho G”, from which material was being stripped prior to the explosion of the white dwarf in the supernova event, does still exist and has been studied in some detail as published in 2004.<sup>9</sup> Since the supernova explosion in 1572 Tycho G has moved 2.6 arcseconds south in the sky and it is still within a radius of 40 arcseconds of the original supernova centered on the current center of the X-ray remnant. Tycho G is a star of type G0-G2IV, much like our sun, located at the distance of the supernova event. It moves in space at 136 km/s. This velocity is more than 3x faster than the mean velocity of the surrounding stars. The authors conclude this extra velocity was imparted by the supernova event. Tycho G’s metallicity in Fe and Ni are similar to values found for our own sun; it is about the same subgiant size and has about the same luminosity and color but is a bit more evolved. Tycho G has low surface gravity which can be interpreted as a consequence of outer mass stripped by the impact of the supernova explosion.



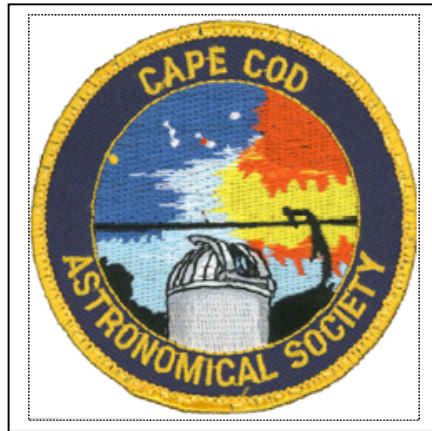
## Cape Cod Astronomical Society

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Director R&D	Bill McDonough	508-771-0471
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Treasurer	Pio Petrocchi	508-362-1213
Observatory Director	Michael Hunter	508-385-9846
Observatory		508-398-4765

The **Cape Cod Astronomical Society** meets at 7:30 pm on the first Thursday of every month in the library of the Dennis-Yarmouth Regional High School in Yarmouth, Massachusetts. Meetings are open to the public. Membership dues are \$30 for adults, \$15 for students in two year colleges and part year residents, and no charge for spouses or for students in K-12 schools.



### Reference Information:

- 1) Information for The Mooncussers Almanac and Monthly Observing Alerts was extracted from Sky Events, Astronomy Magazine Online (Astronomy.com), Stargazing.net's Planet Rise/Transit/Set calculator (<http://www.stargazing.net/mas/planet2.htm>), *Astronomy Magazine*, *Sky & Telescope Magazine*, *Sky and Telescope Skywatch 2007*, and other sources. The *Observer's Handbook, 2007 and 2008*, published by The Royal Astronomical Society of Canada is also an important reference, particularly for information on lunar libration and declination and the minima of Algol.
- 2) Information on how Libration and Declination Maxima and Minima can make visible parts of the moon normally hidden was reviewed in the December-January First Light. Quick recap: Max Long brings to view extra right side; Min Long, extra left side; Max Lat, extra north side; Min Lat, extra south side. Max Dec puts it high in our sky during its transit; Min Dec puts it low.
- 3) Algol is an eclipsing variable star in Perseus which has its brighter component eclipsed or covered by its companion once every 2.87 earth days. When the dimmer component is not eclipsing the brighter, Algol appears typically about magnitude 2.1; when eclipsed, magnitude 3.3 The minima usually lasts about two hours with two hours on either side to bring it back to mag 2.1. Good comparison stars are  $\gamma$ -Andromedae to Algol's west, mag 2.1, and  $\epsilon$ -Persei to its east, mag 2.9.
- 4) [http://www.nasa.gov/mission\\_pages/shuttle/shuttlemissions/hst\\_sm4/index.html](http://www.nasa.gov/mission_pages/shuttle/shuttlemissions/hst_sm4/index.html)
- 5) Tycho Brahe's 1572 supernova as a standard type Ia as revealed by its light-echo spectrum; Oliver Krause, Masaomi Tanaka, Tomonori Usuda, Takashi Hattori, Miwa Goto, Stephan Birkmann & Ken'ichi Nomoto, *Nature*, Volume 456 Number 7222, p617ff, 12/4/08
- 6) Universe Today (<http://www.universetoday.com/2008/12/03/astronomers-time-travel-to-16th-century-supernova/>)
- 7) <http://news.bbc.co.uk/2/hi/science/nature/7763179.stm> Footage courtesy of Max-Planck-Institut für Astronomie)
- 8) (<http://news.bbc.co.uk/2/hi/science/nature/7763240.stm> Footage courtesy of Max-Planck-Institut für Astronomie)
- 9) Ruiz-Lapuente, F. Comeron, J. Méndez, R. Canal, S. Smartt, A. Filippenko, R. L. Kurucz, R. Chornock, R. J. Foley, V. Stanishev & R. Ibata, 2004, "The binary progenitor of Tycho Brahe's 1572 supernova", *Nature*, 431, 1069).