THE UNIVERSITY OF WESTERN AUSTRALIA

Summer Down Under Research Internship

5 July – 27 August 2021

2021 (July) Projects

2021 UWA SUMMER DOWN UNDER: RESEARCH INTERNSHIP INFORMATION

Application Procedure

Application Dates:
Early bird round: Feb to 31 Mar 2021
2nd round: 1 April to 31 May 2021 (some projects might not be available)

Review this list of projects and select up to 2 preferred projects

Use this link to apply: http://uwa.qualtrics.com/jfe/form/SV_b3CqqzM1QyD1xfU or QR code

Application preparation:
You will need to attach the most up to date

- Transcript
- CV (no more than 1 page)
- English results (not required for native speakers)

You will also be required to answer the following questions:

- Explain why your previous experience makes you suitable for this project?
  In particular, address any prerequisites that have been outlined by the supervisor. (max 200 words)
- Outline any previous research or laboratory experience you have. Please name that research group and the leader of that research group at your home university or the institution that you participated in research. (max 100 words)
- Why are you interested in this program? (max 200 words)
- What are your future career plans? (max 200 words)

You may contact the supervisor(s) if you have questions regarding the project(s). Please note: as student selection is based on a competitive process, **please do not discuss acceptance.** Some projects are designed to be deliberately vague to suit the students' area of interest/specialty. Interested students are recommended to contact the supervisor to discuss the project.

If you plan to do this Research Internship for credit, contact your university's international/mobility office to let them know of your plans.

Please note:
This is an Online Summer Down Under Research Internship. It means that the program will be conducted **online**, during office hours, Australian Western Standard Time. This program has 2 components, the coursework component and the research internship component.
The Coursework component consists of lecture and tutorials. Students from different time zones may choose to watch the video recording and attend lectures "asynchronous-ly". Students will get most value by participating in tutorials (about 3) "in person" online.
The Research Internship component whereby students work directly with UWA supervisors, a mutually suitable time can be discussed. Students are encouraged to contact UWA supervisors to discuss the project and suitable time times. Please do not discuss acceptance.

Due to travel restrictions, if you are not located in Western Australia, need a VISA or cannot be in Perth(UWA) from 5 July – 27 Aug 2021, please select either "Online Only" or "Both Online and Face to Face" projects. You can do this Research Internship remotely (online).

If you are currently located in WA and can be in Perth(UWA) from 5 July – 27 Aug 2021, you may select "Online Only", "Face to Face Only" or "Both Online and Face to Face" projects.

Program details see Summer Down Under: Research Internship

Contents

School: School of Social Sciences	
Main Supervisor: Dr Clare Mouat	**Co-supervisor(s):**
Project title:	**Co-living that's out of this world! Reciprocal insights for planning community wellbeing between outer space and (post)pandemic cities**
Lab/Group: Geography and Planning	

Project description:

Project 1

Prospects for living in outer space have been widely discussed in media, fiction, science, and policy as well as capturing our imaginations. Now space tourism and space enterprise are ramping up national and pan-global negotiations that pressure conventions such as the UN conventions on the peaceful use of outer space. Australia has a space agency (https://www.industry.gov.au/policies-and-initiatives/australian-space-agency) and shows some of the range of opportunities, benefits, and challenges for space and space technologies. In 2021 The UWA International Space Centre has been launched (https://internationalspacecentre.org/). This project fits within the living and working hub of the UWA ISC (https://internationalspacecentre.org/living). For the purposes of this SDURI programme, this interdisciplinary project focuses on understanding the conventions and inventions necessary for planning and living in healthy urban spacescapes: framing the nature of the frontiers of spacescape planning and conviviality that span from the settlement, migration, and governance down to the 'kitchen table' realities of co-living as well as the conflicts that arise.

This project uses the lens of urban planning and political geography to explore the reciprocal and emerging considerations of planetary and cosmic commons for civility and human flourishing in hostile environments (of the present and future development of space and the (post)pandemic city). In this context urban planning has helped define our inherited structures and functions in our cities. The research questions for the project will be developed by the student and stem broadly from the questions: what are the 'urbanisms' of the possible spacescape and how will they be governed in relation to living and working in planetary and outer space? The research will include a literature review, collection of critical case studies and policies as comparative exemplars, and possible agenda projects for ongoing research and policy recommendations into a fuller PhD project.

Required skills, knowledge or experience:

Postgraduate student or senior undergraduate preferred.

Suggested Undergraduate major in human geography, planning, politics or political science, law, environmental science, anthropology, sociology; qualitative/quantitative research skills training.

Student contribution: the exact details of the student's role will be worked out in consultation with the student. The student will likely be involved in qualitative data design, case study and data collection, analysis, research management, data entry and analysis, plus written and graphic communication of findings.

Keywords: Urban planning, governance, innovation, community, outer space, cosmic commons	
Supervisor Contact email: clare.mouat@uwa.edu.au	
Project supervised: Both online and Face to Face	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 5	**Total number of place(s) available with supervisor:** 6 (1 for this project)

School: School of Social Sciences	
Main Supervisor: Dr Clare Mouat	**Co-supervisor(s) :**
Project title:	**Sustainable living and livelihoods for beekeeping in Western Australia**
Lab/Group: Geography and Planning	

Project description:

Project 2

Securing beekeeper livelihoods is under-examined despite the booming beekeeping industry of Western Australia and the changing climate. This project aims to identify and examine vital dimensions of sustainable beekeeper livelihoods that need to underwrite policy reforms and strategies towards improving the visibility and viability of beekeeping industry and their reliance on public lands in Western Australia. These public lands need to be better managed as commons (from an alterglobalisationist approach rather than Ostrom's institutional perspective) with a range of stakeholders and across governance regimes and scales.

This project will quantify and improve understanding of a typology of professional beekeepers (to differentiate fully commercial from hobby or part-time beekeepers), and model key government apiary site frameworks/mechanisms that will allow beekeepers to appropriately use, value and protect apiary sites as public resources thereby securing commercial beekeeper livelihoods and the wider industry. Working towards such a model is needed to help professionalise the industry, allow differential access to apiary sites (avoiding blunt interventions and their perverse effects), and safeguard the landscape for present and future generations and multiple users.

Note that the beekeeping research project that I am proposing is distinct from but informed by my involvement with a broader research group (http://www.crchoneybeeproducts.com/) and I have a PhD student within that group (her original project description is seen at https://politicalecologynetwork.org/tag/beekeeping/) with whom we could collaborate. Following the summer school, should you be interested in developing a PhD project, there are plenty of real world problems that need to be addressed within the commons management and commercial beekeeping in WA and Australia (and internationally).

Required skills, knowledge or experience:
Postgraduate student or senior undergraduate preferred.

Suggested Undergraduate major in human geography, planning, politics or political science, law, environmental science, anthropology, sociology; qualitative/quantitative research skills training.

Student contribution: exact details of the student role will be worked out with the student. The student will likely be involved in qualitative data design, case study and data collection, analysis, research management, data entry and analysis, plus written and graphic communication of findings.

Helpful skills: knowledge of Qualtrics, NVivo, and working with Census/ABS data

Project is adaptable to suit student interest and location.

Keywords: Beekeeping, sustainable livelihoods, resource conflict, public policy, commons	
Supervisor Contact email: clare.mouat@uwa.edu.au	
Project supervised: Both online and Face to Face	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 5	**Total number of place(s) available with supervisor:** 6 (1 for this project)

School: School of Social Sciences

Main Supervisor: Dr Clare Mouat | **Co-supervisor(s) :**

Project title: **Illuminating Night Studies: the pathways, policies and priorities for planning healthy Local Urban Nightscapes and Regeneration (LUNAR) across Australasia**

Lab/Group: Geography and Planning

Project description:

Project 3

Many sustainability projects routinely focus on day-time conditions and activities in a climate of global change. Yet the way we plan, develop, and live in our cities and homes during the night needs our urgent attention. Responding to international calls for Night studies, this project focuses on planning for healthy Local Urban Nightscapes and Regeneration (LUNAR) across Australasia with lessons from and for international areas.

The project task requires interns to help advance policy responses for healthy LUNAR by exploring how artificial lighting regimes (ALR) affect (more-than-) human and ecological health and the politics of light in cities via

1. Building understanding how communities and stakeholders understand ALR in terms of commons and ecological light pollution in local urban places, and
2. Developing ways to examine the multi-scale regenerative potential via planning policies and practices.

Urban nightscapes have ALR that dramatically and variably affect economic, social, and ecological sustainability. ALR are regulated systems of night lighting – permanent and temporary – including streetlights; lighting from industrial, residential, civic, commercial, festival, and construction sources. While lighting at night offers many benefits (productivity, safety, and entertainment, for example), it can also cause problems for human and non-human health through light and ecological pollution. Light pollution includes sky glow from ALR sources that obscure the night sky (today more than one third of humanity cannot see the Milky Way). More broadly, ecological light pollution disrupts ecological health of humans and non-humans (plants, animals, and insects) in a wide variety of ways.

Wise cities, not smart cities, are needed to balance urban development, ecological wisdom, and planning practices. The project may use surveys and policy review/reform development to explore the range of healthy and unhealthy ALR to find ways for communities to appreciate and create healthier and more regenerative ALR in their local and significant places across Australasia. Consequently, communities can collaborate with local councils and developers to better inform how we plan, promote, and develop safe and healthy cities (SDG11). For healthy urban development, planners need a better understanding about how communities relate to the night sky and nightscapes of their urban places, and communities need to better understand the technologies and systems that offer or restrict lighting innovations. In so doing, communities and planners can better appreciate the trade-offs and effects of ALR and wise city imperatives for healthy and sustainable nightscapes.

Required skills, knowledge or experience:
Suggested undergraduate major in human geography and planning, environmental science, anthropology, sociology, public health; qualitative or quantitative research skills training.

Student contribution: the exact details of the student's role will be worked out in consultation with the student. The student will likely be involved in qualitative and/or quantitative data collection and analysis, including individual and focus group interviews, data entry, analysis, plus written and graphic communication of findings.

Project is adaptable to suit student interest and location.

Keywords: Artificial lighting, urban planning, health, community governance, regenerative sustainability

Supervisor Contact email: clare.mouat@uwa.edu.au

Project supervised: Both online and Face to Face (fieldwork TBA)	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 5	**Total number of place(s) available with supervisor:** 6 (1 for this project)

School: School of Social Sciences	
Main Supervisor: Dr Clare Mouat	**Co-supervisor(s):** Prof Shelley Kinash Prof. Kevin McDougall Prof Sally Male Dr Dino Spagnoli
Project title:	**Getting into the good graces of higher education: Understanding policies, pathways, and priorities to Graduate Employability and Career-Readiness ExperienceS (GRACES) in two Australian Universities**
Lab/Group: Geography and Planning (interstate collaborators)	

Project description:

Project 4

As part of a multi-disciplinary inter-state research project (outlined below), this project will explore student responses and university policies for enhancing graduate employability and career-readiness experiences (GRACES). Specifically, it will examine the diverse student pathways and priorities in assessment and learning at multiple Australian universities (research and/or teaching intensive).

Developing graduate employability and career-readiness is increasingly prioritised across Australian universities including the G8 coalition of Australia's world-leading research-intensive universities. Creating and reporting evidence of GRACES are now key measures of educational value, impact, and social responsibility for the contemporary university and their staff and students (prospective and current). GRACES straddle the spectrum of work-integrated learning from internships to industry engagement and in-class work-relevant skill development (such as group work and presentations or report writing) with the conventional rigours of research-led teaching. Embedding and developing GRACES in the contemporary research-intensive university is a particular challenge, especially given the differential capacities (including prestige legacies, soft and hard infrastructures, perceptions, and expectations of universities) of leadership, staff, students, and external stakeholders). The aim of the current research is to champion G8 universities to be nimble, pragmatic, and responsive (rather than reactive) to this pressing educational priority. Specifically, the project aspires for UWA to be responsive by leading and embedding transformational education capacities that will achieve meaningful work-integrated learning and employability experiences for staff and students as well as for potential employers and wider society.

Required skills, knowledge or experience:
Postgraduate student or senior undergraduate preferred.

Suggested Undergraduate major in human geography, planning, politics or political science, law, environmental science, anthropology, sociology; qualitative/quantitative research skills training.

Student contribution: exact details of the student role will be worked out with the student. The student will likely be involved in qualitative data design, case study and data collection, analysis, research management, data entry and analysis, plus written and graphic communication of findings.

Project is adaptable to suit student interest and location.

Keywords: Employability, work-integrated learning, higher education, academic governance, students	
Supervisor Contact email: clare.mouat@uwa.edu.au	
Project supervised: Both online and Face to Face	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 5	**Total number of place(s) available with supervisor:** 6 (1 for this project)

School: School of Social Sciences

Main Supervisor: Dr Clare Mouat	**Co-supervisor(s):**

Project title:	**Community Matters! The place and relations of community engagement with government in urban development and regime reforms**

Project description:

Project 5

This project draws on emerging research on local and comparative planning system reforms relating to community engagement in the reform process and development of their local communities. The project will emphasis mapping the contours and challenges of evolving planning reforms and the (persistent and emerging issues of) community engagement in comparative analysis (perhaps from Ireland, Canada, UK and Western Australia). Working with a range of potential collaborators, we are keen to develop projects which emphasizes the drivers, power, and (missed/mis-used) opportunities of systemic reform; and that can deepen, extend or challenge our reckoning of these reforms for community: especially for community consultation, good governance, and social governance innovation that advancing equitable outcomes.

A range of qualitative data collection techniques will capture and chart the distinctive reforms, the proposed future development trajectories and mechanisms and the implications for democracy, planning education, and wiser and more collaborative civic governance.

As the project can be tailored to student needs, I encourage students to contact me at any stage for a conversation about possible projects.

It would also help you to review materials from Canada, Ireland, UK and Australia relating to the priorities of reform and the place and relations of community engagement in the process, such as:

- VancouverPlan https://vancouverplan.ca/ (often an international benchmarking plan) and file:///C:/Users/00081776/AppData/Local/Temp/cities_in_a_sea_of_uncertainty_april18_2017.pdf
- The TCPA (UK) report "The Right Answers to the Right Questions?" https://www.tcpa.org.uk/the-right-answers-to-the-right-questions
- The WA Department of Planning, Lands and Heritage website on planning reforms: https://www.dplh.wa.gov.au/planning-reform and https://www.dplh.wa.gov.au/projects-and-initiatives/planning-for-the-future alongside the COVID-19 reforms https://www.dplh.wa.gov.au/projects-and-initiatives/planning-reform/covid-19-planning-reforms

Required skills, knowledge or experience:

Undergraduate in human geography and planning, politics, anthropology, sociology, history, qualitative or quantitative research skills training. *Helpful skills*: Policy analysis, SurveyMonkey NVivo

Student contribution: the exact details of the student's role will be worked out in consultation with the student. The student will likely be involved in qualitative and/or quantitative data collection and analysis, including individual and focus group interviews, data entry and analysis and report writing.

We are open to student-initiated projects in a range of different geographical locations which pick up on the key concerns raised by our project but explore how these play out in case studies and comparative analysis.

Keywords: community engagement, Urban planning, planning reform, governance, equity

Supervisor Contact email: clare.mouat@uwa.edu.au

Project supervised: Both online and Face to Face	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 5	**Total number of place(s) available with supervisor:** 6 (2 for this project)

School: School of Social Sciences	
Main Supervisor: Prof Loretta Baldassar	**Co-supervisor(s):** Dr Catriona Stevens and Dr Lukasz Krzyzowski
Project title: SAGE Lab – social ageing and social technologies	
Project description: Project 1 The UWA SAGE Lab (Social Care and Ageing Living Lab) is a research entity based in the School of Social Sciences. Our research projects feature person-centred, co-design, and social innovation methodologies that bring together academics, industry partners and end-users to respond to critical issues. A 'social ageing' approach to aged care emphasises the role and value of the relationships in an individual's social support network (formal and informal), including with the environment (physical and structural), as well as the use of technologies to mediate local, virtual and distant support networks. The approach supports the development of collaborative communities of care that extend older people's support networks. SAGE Lab research is conducted in collaboration with research partners from multiple sectors, including care providers, medical and health services, community organisations, state and local government.	
Required skills, knowledge or experience: Undergraduate major in anthropology, sociology, gerontology, public health; qualitative or quantitative research skills training. **Student contribution:** The exact details of the student's role will be worked out in consultation with the student. The student will likely be involved in qualitative and/or quantitative data collection and analysis, including individual and focus group interviews, data entry and analysis and report writing.	
Keywords: ageing, aged care, social technology, community development, migrant careworkers	
Supervisor Contact email: catriona.stevens@uwa.edu.au	
Project supervised: Both online and Face to Face	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 2	**Total number of place(s) available with supervisor:** 5

School: School of Social Sciences	
Main Supervisor: Prof Loretta Baldassar	**Co-supervisor(s):** Dr Lukasz Krzyzowski
Project title:	**Internationalisation at Home - Student Research Project**
Lab/Group Link: http://blogs.uwa.edu.au/lorettabaldassar/home/iah/	

Project description:

Project 2

Internationalisation at Home - Student Research Project

Built-in as part of the formal curriculum in the 4th year Anthropology and Sociology Honours unit, ANTH4101 Advance Qualitative Methods: Interviews and Focus Groups, this project both develops initiatives that offer guided opportunities for local and international students to engage with each other, and allows students to collect data on international/local student interaction that contributes to their own personal research assignments and a broader research project.

These objectives respond directly to the UWA Strategic Plan in improving the student experience, developing research and research training and the teaching/research nexus. As part of their contribution to this research project, students produce a research report and poster based on their analysis of the data they collected. For a detailed look at these reports and posters please click here. International student partners will audit this unit and collaborate on joint student-led projects.

Required skills, knowledge or experience:

Undergraduate major in anthropology, sociology, youth studies, social work, human geography, public health; qualitative or quantitative research skills training.

Student contribution: the exact details of the student's role will be worked out in consultation with the student. The student will likely be involved in qualitative and/or quantitative data collection and analysis, including individual and focus group interviews, data entry and analysis and report writing.

Keywords: Student study abroad; internationalisation at home	
Supervisor Contact email: loretta.baldassar@uwa.edu.au	
Project supervised: Both online and Face to Face	Length of project: Standard 8 weeks
Total number of project(s) offered by supervisor: 2	**Total number of place(s) available with supervisor:** 5

School: Graduate School of Education	
Main Supervisor: Prof Vaille Dawson	**Co-supervisor(s):**
Project title:	**Climate change education in schools: a cross country comparison**

Project description:

The focus of this research is climate change education and its status in the compulsory years of secondary school across various global North and global South countries. The applicant will use document analysis to interrogate formal school curriculum documents, specifically science and geography to determine the presence of climate change topics and the way they are addressed in these core subjects. The applicant will write a summary report with recommendations for government policy-makers, school leaders and other stakeholders.

Required skills, knowledge or experience:

High standard of English written communication
Understanding of secondary school systems and curricula in home country
Teaching background (optional)

Keywords: climate change education, higher education, policy,	
Supervisor Contact email: Vaille.dawson@uwa.edu.au	
Project supervised: Both online and Face to Face	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 1	**Total number of place(s) available with supervisor:** 2

School: Law School	
Main Supervisor: Prof Erika Techera	**Co-supervisor(s) :**
Project title: Oceans governance	
Project description: The project will explore international environmental law that addresses the problem of marine invasive species. The focus will be on exploring the different pathways for introduction of species and in particular ballast water and bio-fouling of ships. Whilst there is a new treaty on ballast water, there is no binding international law directly addressing bio-fouling. The research will involve collating literature on the extent of the marine invasive species challenge and its causes, examining existing international law that addresses these causes, analysing in detail the specific laws for ballast water and bio-fouling, and identifying some potential ways forward to improve oceans governance.	
Required skills, knowledge or experience: Knowledge of international environmental law. The student need not be a law student, but if not, s/he must have studied international environmental law. It is possible that a law student who has studied public international law, but not international environmental law, may be suitable depending upon other subjects undertaken.	
Keywords: International environmental law, oceans, biodiversity conservation, governance, invasive species	
Supervisor Contact email: erika.techera@uwa.edu.au	
Project supervised: Both online and Face to Face	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 1	**Total number of place(s) available with supervisor:** 2

School: Law School

Main Supervisor: Dr Jade Lindley	**Co-supervisor(s):** Dr Natalie Brown

Project title: **Support for law PhD students**

Project description:

This project follows on from research conducted in 2018 and published in 2020 as to understanding what institutional and personal factors lead to Australian law PhD students completing successfully. This project intends to further the results found in that research, namely understanding what aspects of law PhD supervision are most critical and how to train law academics to best support their students. This will occur through (1) a literature review; and (2) an online survey. The results of this will be finalised as an academic journal article.

Project 1 Task

The intern(s) will be tasked to support the development of the literature that will form the basis of the project. Online literature gathered will be organised following an agreed naming convention and uploaded to a shared Dropbox folder. The intern(s) will analyse themes and write results in a publishable format. The literature will inform the survey questions. The survey questions will be devised in conjunction with the supervisor, drawing on the abovementioned original study and this project's literature review. The intern(s) will work with the supervisor to develop the Human Research Ethics Application for approval prior to the survey being made live online. Other intern tasks include: Managing invitations to conduct the survey; after the close of the survey, analysing themes; writing results; proofreading and referencing; and other related tasks as required for this and related projects.

It is expected that the results of the study will form an academic publication. The intern(s) literature review along with the survey results will form various sections of a journal article. Participation will be encouraged and depending on the quality and quantity of the contribution, it is intended that the **intern(s) may be invited to be named as author(s).**

Required skills, knowledge or experience:

Ability to work well on a new topic with minimal supervision; provide weekly progress updates; organisation skills, especially when working independently; work well in a diverse team; ability to upload and clearly name academic references in Dropbox; familiarity with, or ability to learn referencing tool EndNote; proficient in English writing.

Keywords: Qualitative and quantitative research; academic research; support for law PhD students

Supervisor Contact email: jade.lindley@uwa.edu.au

Project supervised: Online or Face to Face	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 1	**Total number of place(s) available with supervisor:** 1-2

School: Law School	
Main Supervisor: Dr Renae Barker	**Co-supervisor(s):**
Project title:	**State Religion and the Child**

Project description:

Project 1

The state regulates the child's interaction with religion in numerous areas including health, education and family law. In some instances this regulation promotes or protects a child's right to freedom of religion while in others it limits that right in favour of other rights of the child or other members of society (including the child's parents). This project examines various instances of the state via law (legislation and case law) and government policy regulating the child's interaction with law.

The student will be assigned to one interaction between the state and the child depending on the focus of the project at the time and the student's skills and interest in consultation with the supervisor. Students may also be assigned to examine theoretical issues relevant to this project.

Required skills, knowledge or experience:

Familiarity with case law analysis OR Systematic Content Analysis using Nvivo or similar. Students from a common law background (or will experience in a common law jurisdiction) will be preferred.

Keywords: law and religion; children; refusal of medical treatment	
Supervisor Contact email: renae.barker@uwa.edu.au	
Project supervised: Both online and Face to Face	**Length of project:** 8 weeks
Total number of project(s) offered by supervisor: 1	**Total number of place(s) available with supervisor:** 2

School: Law School	
Main Supervisor: Prof Michael Blakeney	**Co-supervisor(s):**
Project title:	**Enforcement of Intellectual Property Rights in Mauritius**
Project description: Collection and analysis of case law in Mauritius, India and South Africa on intellectual property rights and enforcement of those rights.	
Required skills, knowledge or experience: Knowledge of enforcement of civil law and/or criminal law Knowledge of intellectual property rights (optional)	
Keywords: Intellectual property, civil enforcement, criminal enforcement	
Supervisor Contact email: Michael.blakeney@uwa.edu.au	
Project supervised: Both online and Face to Face	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 1	**Total number of place(s) available with supervisor:** 2

School: Law School		
Main Supervisor: Prof Rick Krever		**Co-supervisor(s):**
Project title:	**Images of Tax Avoidance and Evasion in the Press in [Country]**	

Project description:

The law of all jurisdictions makes a sharp distinction between income tax evasion (an unlawful and criminal activity) and income tax avoidance, legal but in the eyes of many unethical or undesirable. There is often press coverage of tax evaders and tax avoidance, particularly by large multinational companies using tax havens and various techniques to shift shifted from high tax jurisdictions to low tax jurisdictions. The study will look at how the press frames tax evasion (usually by high wealth individuals) and tax avoidance (usually by multinational enterprises). It will consider how the issues are framed for different audiences – national papers vs. city or regional papers; tabloids vs broadsheets; one publisher vs another publisher; financial press vs. general press, etc.

If the research is from a jurisdiction with a non-English press, some investigation will be required to find the equivalent terms used in the local language (tax terms such as avoidance or evasion or tax havens are almost never directly translated).

Required skills, knowledge or experience:

Some knowledge of tax would be helpful, but not essential. Some experience researching data bases such as newspaper data bases would be very helpful; otherwise, some time will be needed to learn the new skills. Some knowledge of media framing theory would be helpful. Some knowledge of data analysis programs such as NVIVO would be helpful, but not essential. Experience with data analysis and graphic presentation would be helpful.

Keywords: Press framing, tax avoidance, tax evasion, tax havens	
Supervisor Contact email: rick.krever@uwa.edu.au	
Project supervised: Online only	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 1	**Total number of place(s) available with supervisor:** 4

School: Business School	
Main Supervisor: Dr Andrew Williams	**Co-supervisor(s):** Prof Ken Clements, Dr Ian Li
Project title:	**Employment Opportunities for Graduates in Economics: Number, Sector and Nature of Work**

Project description:

Economics is recognised as being an important field in society, and a degree in economics has come to be acknowledged as a sought after qualification. However, the nature of work opportunities for graduates in economics is not well understood. It is not known, for instance, whether job opportunities for economics graduates beyond "traditional" positions (e.g. economist, analyst) exist. The amount of positions available for economics graduates is also unknown.

This project aims to utilise web-scraping methods to extract jobs information from online job boards (Indeed.com; Seek.com). Data on the number of jobs available, salaries (where available), contract type (fixed term, permanent or ongoing, casual), criteria (qualifications required, other attributes desired or essential), sector (government, industry, NGOs), state will be extracted and analysed.

This exciting project will contribute to the information needed by students in making career choices and enhance the smooth functioning of the professional labour market.

The successful applicant for this project will assist with the development of the protocol for the web-scraping tool, undertake a literature review, and (possibly) deploy the web-scrape protocol in a pilot trial. These activities will be guided and supported by the project supervisors.

Required skills, knowledge or experience:

- Excellent written and oral communication skills
- Excellent skills in literature searching and synthesising, or the capacity to learn these skills
- Familiarity with data analysis and statistical software
- Experience in web-scraping or coding is desirable

Keywords: workforce; web-scraping;	
Supervisor Contact email: andrew.williams@uwa.edu.au	
Project supervised: Both online and Face to Face	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 1	**Total number of place(s) available with supervisor:** 1

School: Business School	
Main Supervisor: Dr Girish Bahal	**Co-supervisor(s):** Sriya Iyer (Cambridge University) and Anand Shrivastava (Azim Premji University)
Project title:	**Covid-19 and Religion**

Project description:

Project 1

The battle for control over the Covid-19 pandemic is international. The disease has not only affected a subset of the population that is infected with it but has also severely affected employment opportunities, economic growth, and general health and well-being of people across the globe. To arrest the exponential growth in infection around the world, it is crucial to understand the key factors that have led to the rapid diffusion of this infection. In a recent article examining COVID-19 super-spreader events in 28 countries, 9 out of 54 such events were religious gatherings. This project aims to understand how religious gatherings and religious networks spread infectious diseases such as Covid-19. Second, we aim to understand how Covid-19 induced restrictions and the inability to attend in-person religious congregations have affected mental health.

Required skills, knowledge or experience:

Some training in economics is advantageous but not necessary. Knowledge of statistical software like Stata is preferred but again not necessary. Tasks will involve collection, cleaning, and analysis of data related to religion, religious congregations, and mental health indicators in the US. The RA(s) will also help in the collection of news articles that report religious congregations as a source for the spread of Covid-19 infections.

Keywords: Covid-19, Religion, Economics, Networks	
Supervisor Contact email: girish.bahal@gmail.com	
Project supervised: Both online and Face to Face	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 2	**Total number of place(s) available with supervisor:** 5

School: Business School	
Main Supervisor: Dr Girish Bahal	**Co-supervisor(s):** Jan Feld (Victoria University of Wellington)
Project title:	**Anticipated discrimination: measuring attitudes at workplace**

Project description:

Project 2

In this project, we measure anticipated gender discrimination. In particular, we ask survey respondents to predict how women and men with identical characteristics will fare in a given job. We would then have evidence for anticipated discrimination against women, for example, if respondents predict that women would have a lower chance of getting promoted than men with the same characteristics. Understanding how anticipated discrimination against women varies across occupations will help us better understand the extent to which gender gaps in occupational choices are driven by women avoiding fields in which they expect to be discriminated against.

Required skills, knowledge or experience:

Some training in economics is advantageous but not necessary. Knowledge of statistical software like Stata is preferred but again not necessary. Tasks will involve collection, cleaning, and analysis of data.

Keywords: Labor economics, Discrimination, Preferences at workplace	
Supervisor Contact email: girish.bahal@gmail.com	
Project supervised: Both online and Face to Face	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 2	**Total number of place(s) available with supervisor:** 5

School: Business School

Main Supervisor: Dr Ishita Chatterjee	**Co-supervisor(s):** Mr Adnan Fakir

Project title: **Worldwide Protests and Female Empowerment**

Project description:

The project explores the role played by protests on female empowerment, especially in developing countries. Political protests are the most common form of local disruptions stemming from political processes. While majority of such events are generally meant to be non-violent, they may have unintended consequences on human capital development, especially for women.

Exposure to violence, in-utero or during early years, is well established to affect child health outcomes and child's education in the academic literature. Studies that have explored this nexus mostly focused on the role of civil, communal or religious conflict, while the role of non-violent protests remains to be explored. Addressing this gap in the literature, this project focuses on the impact of these politically motivated non-violent protests on female empowerment in terms of employment, earning abilities, skill development and self-esteem. We intend to combine multiple rounds of Demography and Household Survey (DHS) datasets from about 50 countries with political protests data from either the Armed Conflict Location and Event Data (ACLED) project or the Global Database of Events, Language, and Tone (GDELT) project to conduct the analyses.

The project outcome is to a peer-reviewed research manuscript submission in December 2021.

Required skills, knowledge or experience:

Required: A background of study in either economics, computer science, sociology, politics or public policy.

Student contribution: exact details of the student role will be worked out with the student. The student will likely be involved in literature review, data analysis, plus written and graphic communication of findings.

The main challenge of this research is to clean and merge the DHS and ACLED/GDELT datasets. Students with quantitative research skills training and familiarity with Stata software (and/or Python for working with GDELT) highly recommended.

Keywords: protests, female empowerment, non-violence

Supervisor Contact email: ishita.chatterjee@uwa.edu.au

Project supervised: Both online and Face to Face	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 1	**Total number of place(s) available with supervisor:** 1

School: Business School

Main Supervisor: Prof Yanrui Wu	**Co-supervisor(s):**

Project title: **Carbon Emission in Australian LNG Sector**

Lab/Group: Department of Economics
(https://research-repository.uwa.edu.au/en/persons/yanrui-wu)

Project description:

Project 1

During the pandemic panic, there is a lot of discussion about a gas-led economic recovery in Australia. However natural gas is a fossil fuel (though cleaner than oil and coal) and carbon emission is generated during the process of production, transport and consumption. This project aims to explore the carbon footprint of Australia's LNG sector which is to become the largest exporter in the world. The findings will help gain insight into the perspective of the LNG sector towards the goal of net zero emissions by mid century, consistent with the Paris Agreement.

Project 2

The second part of this project is to investigate various scenarios towards carbon neutral in the LNG sector. It involves literature review, discussion of abatement methods and possible adoption in Australia. Policy recommendations are provided.

Project 3

The third part of this project presents a case study of the fertiliser industry or a fertiliser producer such as WesCEF (a gas consumer). The purpose is to examine possible carbon pricing to achieve net zero emission by 2050. Work on this project involves literature review, scenario analysis and policy recommendations.

Required skills, knowledge or experience:

A background of study in either economics, environmental policy or business is highly recommended. Experience in quantitative analysis is desirable.

Keywords: natural gas; climate change; carbon neutral; emission offset; carbon pricing

Supervisor Contact email: yanrui.wu@uwa.edu.au

Project supervised: Online and Face to Face	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 3	**Total number of place(s) available with supervisor:** 3

School: School of Biological Sciences	
Main Supervisor: Prof David Edwards	**Co-supervisor(s):** Dr Philipp Bayer
Project title: **Applied bioinformatics**	
Lab/Group: UWA applied bioinformatics group **Lab/Group Link:** http://www.appliedbioinformatics.com.au/ **Publications:** https://scholar.google.com.au/citations?user=AxsOkqYAAAAJ&hl=en	
Project description: We develop custom projects in the area of applied bioinformatics depending on the student's interests and experience. Projects mostly align with ongoing activities in plant genomics, applying big data to understand plant evolution and crop performance using high performance computing and diverse approaches including machine and deep learning.	
Required skills, knowledge or experience: Students require an understanding of biology and experience of working in a Linux environment. Coding may be required for some projects.	
Keywords: Genomics, plants, bioinformatics, machine learning, evolution	
Supervisor Contact email: Dave.Edwards@uwa.edu.au	
Project supervised: Face to Face only	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 1	**Total number of place(s) available with supervisor:** 5

School: School of Biological Sciences	
Main Supervisor: Prof Jacqui Batley	**Co-supervisor(s) :**
Project title:	**Genomics of Plant Pathogen Interactions**
Lab/Group: Batley Lab **Lab/Group Link:** www.batleylab.net	
Project description: Research on the interactions between plants and pathogens has become one of the most rapidly moving fields in the plant sciences, findings of which have contributed to the development of new strategies and technologies for crop protection. A good example of plant and pathogen evolution is the gene-for-gene interaction between the fungal pathogen Leptosphaeria maculans, causal agent of Blackleg disease, and Brassica crops (canola, mustard, cabbage, cauliflower, broccoli, Brussels sprouts). The aim of this project is to use whole genome sequencing technologies to characterise the diversity and evolution of these genes in different wild and cultivated Brassica species. This will involve phenotypic analysis of the disease in a variety of cultivars and species and genetics to link to the phenotype.	
Required skills, knowledge or experience: Keen interest in plant biology, with knowledge of DNA and genetics	
Keywords: Genome sequencing, plant pathogen interactions, crop protection, evolution, food security	
Supervisor Contact email: Jacqueline.batley@uwa.edu.au	
Project supervised: Both online and Face to Face	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 1	**Total number of place(s) available with supervisor:** 3

School: School of Molecular Sciences	
Main Supervisor: Dr Alyssa Van Dreumel	**Co-supervisor(s):**
Project title:	**Beyond Borders in a Digital World: Development of a Collaborative Online International Learning activity – Academic and Social Integration Project**

Project description:

The learning experience of many international students is impacted by difficulties integrating with student cohorts from different backgrounds. This issue is particularly pronounced in the case of articulation students, who tend to arrive part-way through a course and in groups who already have strong internal connections; as is the case for a cohort of international students in the School of Molecular Sciences.

This project will focus on two domains: social and academic integration; with a specific focus on establishing peer-to-peer learning and an intercultural social peer network. The aim of this project is to develop an initiative that offers a guided opportunity for domestic and international students to engage with each other prior to transfer to UWA. These objectives respond directly to the UWA Strategic Plan in improving the student experience.

As part of their contribution to this research project the student will produce a research report including a proposed lesson plan for a COIL activity, and poster based on their analysis of the data they collect. International student and academic partners may collaborate on student-led projects.

Required skills, knowledge or experience:

Solid theoretical knowledge of molecular biology and/or biochemistry, or chemistry, or related biological science, or undergraduate degree in education majoring in biological science; qualitative or quantitative research and data analysis and communication skills. The best-placed student would also possess an interest in education and sociology.

Student contribution:

The exact details of the student's role will be determined during consultation with the student. The student may be involved in curriculum development and consolation, qualitative and/or quantitative data collection and analysis, including individual and focus group interviews, and written (report writing) and graphic communication of findings.

Keywords: Internationalisation; Collaborative Online International Learning (COIL); Tertiary Education; Integration	
Supervisor Contact email: alyssa.vandreumel@uwa.edu.au	
Project supervised: Both online and Face to Face	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 3	**Total number of place(s) available with supervisor:** 2

School: School of Molecular Sciences	
Main Supervisor: Dr Alyssa Van Dreumel	**Co-supervisor(s):**
Project title:	**Grasping the language: Is English language proficiency or terminology of the scientific discipline the challenge for Sinophone students? - Education Research Project**

Project description:

The project will involve evaluation of written answers to assessment questions sourced primarily from examination papers from international cohorts in the molecular sciences and chemistry. The project may also include interviews with students to elucidate what difficulties students encounter when answering written short answer questions that require articulation of their knowledge of scientific concepts.
Findings from this project will impact how we can assist English as a Second Language (ESL) students in their language development, be it English language proficiency generally or more specifically related to their grasp of the language of biochemistry and molecular biology, and/or chemistry.
As part of their contribution to this research project the student produces a research report and poster based on their analysis of the data they collect.

Required skills, knowledge or experience:

Solid theoretical knowledge of biological, or biochemical and/or molecular biology, or chemistry, or undergraduate degree in education majoring in biological science; qualitative or quantitative research skills training; or degree in linguistics would be well placed. The best-placed student would also possess an interest in pedagogy, teaching, and sociology; and possess problem solving, data analysis and communication skills.

Student contribution:
The exact details of the student's role will be determined during consultation with the student. The student may be involved in qualitative and/or quantitative data collection and analysis, including individual and focus group interviews, and written (report writing) and graphic communication of findings.

Keywords: Internationalisation; Biochemistry & Molecular Biology Education; Linguistics	
Supervisor Contact email: alyssa.vandreumel@uwa.edu.au	
Project supervised: Both online and Face to Face	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 3	**Total number of place(s) available with supervisor:** 2

School: School of Molecular Sciences	
Main Supervisor: Dr Alyssa Van Dreumel	**Co-supervisor(s):**
Project title:	**Global Citizenship: Investigation of student development as global citizens and internationalisation at UWA - Student Research Project**

Project description:

This project involves opportunities for domestic and international students to engage with each other, and allows the student to collect data on international/domestic student interaction that contributes to a personal research assignment and a broader research project.
Suggested research topics include: 1) "Understanding Chinese students' engagement at UWA: an articulation cohort case study in the molecular sciences"; 2) "Cultural awareness of Australian domestic students of international student peers"; 3) Development of a pre-departure micro-credential on cultural awareness for UWA domestic students travelling abroad".
As part of the student's contribution to this research project, they will produce a research report and poster based on their analysis of the data they collect.

Required skills, knowledge or experience:

Interest in cultural studies, sociology, and/or biological sciences. The best-placed student would also have qualitative or quantitative research training, statistical analysis and communication skills.

Student contribution:
The exact details of the student's role will be determined during consultation with the student. The student may be involved in conducting surveys, individual and focus group interviews, qualitative and/or quantitative data collection and analysis, curriculum development and consolation, and written (report writing) and graphic communication of findings.

Keywords: Internationalisation; Academic and Social Integration, Cultural Awareness and Education	
Supervisor Contact email: alyssa.vandreumel@uwa.edu.au	
Project supervised: Both online and Face to Face	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 3	**Total number of place(s) available with supervisor:** 2

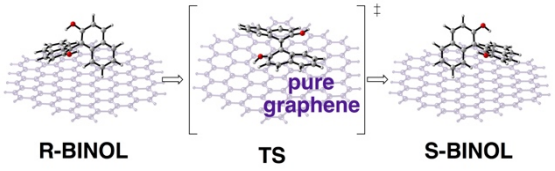
School: School of Molecular Sciences

Main Supervisor: Prof Amir Karton	**Co-supervisor(s): N/A**

Project title:	**Computational Design of Next Generation 2D Catalysts**

Lab/Group: Computational and Theoretical Chemistry Lab
Lab/Group Link: https://www.chemtheorist.com

Project description:



During the past decade computational chemistry has had an unprecedented impact on almost all branches of chemistry as a powerful approach for designing new molecules and materials. The increasing computational power provided by supercomputers and the emergence of highly accurate theories make contemporary computational chemistry one of the most powerful "microscopes" currently available for examining the atomic and electronic details of molecular processes. In my lab we use powerful supercomputers in conjunction with highly accurate theoretical methods to design functional molecules and materials. In this project you will use density functional theory to design two-dimensional nano-materials with tailored properties for catalysis, hydrogen storage, and molecular sensing. For further details see recent papers from our lab:

- A. Karton. Catalysis on Pristine 2D Materials via Dispersion and Electrostatic Interactions. *J. Phys. Chem.* A, 124, 6977 (2020). https://doi.org/10.1021/acs.jpca.0c05386
- A. Kroeger, J. F. Hooper, A. Karton. Pristine graphene as a racemization catalyst for axially chiral BINOL. *ChemPhysChem*, 21, 1675 (2020). https://doi.org/10.1002/cphc.202000426
- T. Hussain, M. Sajjad, D. Singh, H. Bae, H. Lee, J. A. Larsson, R. Ahuja, A. Karton. Sensing of Volatile Organic Compounds on Two-Dimensional Nitrogenated Holey Graphene, Graphdiyne, and Their Heterostructure. *Carbon*, 163, 213 (2020). https://doi.org/10.1016/j.carbon.2020.02.078
- A. Kroeger, A. Karton. Catalysis by pure graphene – From supporting actor to protagonist through shape complementarity. *J. Org. Chem.*, 84, 11343 (2019). https://doi.org/10.1021/acs.joc.9b01909
- K. Alhameedi, T. Hussain, D. Jayatilaka, A. Karton. Reversible hydrogen storage properties of defect-engineered C4N nanosheets under ambient conditions. *Carbon*, 152, 344–353 (2019). https://doi.org/10.1016/j.carbon.2019.05.080
- S. Sun, T. Hussain, W. Zhang, A. Karton. Blue Phosphorene Monolayers as Potential Nano Sensors for Volatile Organic Compounds Under Point Defects. *Appl. Surf. Sci.*, 486, 52 (2019). https://doi.org/10.1016/j.apsusc.2019.04.223
- T. Hussain, B. Mortazavi, H. Bae, T. Rabczuk, H. Lee, A. Karton. Enhancement in Hydrogen Storage Capacities of Light Metal Functionalized Boron–Graphdiyne Nanosheets. *Carbon*, 147, 199 (2019). https://doi.org/10.1016/j.carbon.2019.02.085

Required skills, knowledge or experience:

1) We are looking for highly motivated students interested in computational chemistry
2) A strong background in chemistry is an advantage
3) Basic background in UNIX is an advantage

Keywords: Computational Chemistry, Catalysis, 2D materials, Density Functional Theory

Supervisor Contact email: amir.karton@uwa.edu.au

Project supervised: Both online and Face to Face	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 3	**Total number of place(s) available with supervisor:** 3

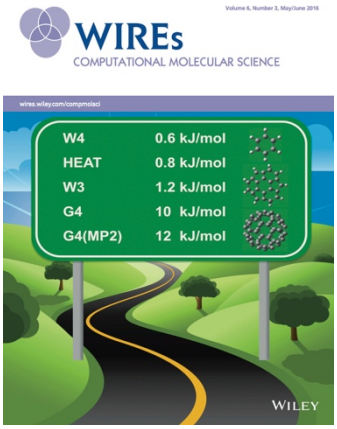
School: School of Molecular Sciences

Main Supervisor: Prof Amir Karton	**Co-supervisor(s):**

Project title: **Development of Economical Quantum Chemical Methods**

Lab/Group: Computational and Theoretical Chemistry Lab
Lab/Group Link: https://www.chemtheorist.com

Project description:



Quantum chemistry composite ab initio methods are the most accurate methods in contemporary computational chemistry. First-principles thermochemical methods, such as Weizmann-n theories, combine large-scale electronic structure calculations with sophisticated extrapolation techniques to achieve unprecedented accuracies in thermochemical, kinetic and spectroscopic predictions. The recently developed explicitly-correlated (F12) techniques extend the applicability of these theories to larger systems. This project will explore the combination of these theories as well as other avenues for reducing the computational cost of ab initio procedures in order to extend their applicability to medium-sized biomolecules. For further details see recent papers from our lab:

- A. Karton. Effective basis set extrapolations for CCSDT, CCSDT(Q), and CCSDTQ correlation energies. *J. Chem. Phys.*, 153, 024102 (2020). https://doi.org/10.1063/5.0011674
- A. Karton. Highly accurate CCSDT(Q)/CBS reaction barrier heights for a diverse set of transition structures: Basis set convergence and cost-effective approaches for estimating post-CCSD(T) contributions. *J. Phys. Chem. A*, 123, 6720 (2019). https://doi.org/10.1021/acs.jpca.9b04611
- B. Chan, A. Karton, K. Raghavachari. G4(MP2)-XK: A Variant of the G4(MP2)-6X Composite Method with Expanded Applicability for Main Group Elements up to Radon. *J. Chem. Theory Comput.*, 15, 4478 (2019). https://doi.org/10.1021/acs.jctc.9b00449
- A. Karton. Post-CCSD(T) contributions to total atomization energies in multireference systems. *J. Chem. Phys.*, 149, 034102 (2018). https://doi.org/10.1063/1.5036795
- A. Karton. A computational chemist's guide to accurate thermochemistry for organic molecules. *Wiley Interdiscip. Rev. Comput. Mol. Sci.*, 6, 292 (2016). http://dx.doi.org/10.1002/wcms.1249

Required skills, knowledge or experience:

1) We are looking for highly motivated students interested in computational chemistry
2) A strong background in computational/theoretical chemistry is an advantage
3) Basic background in UNIX and/or programming is an advantage

Keywords: Ab Initio Methods, Coupled Cluster Theory, Basis Set Extrapolations

Supervisor Contact email: **amir.karton@uwa.edu.au**

Project supervised: Both online and Face to Face	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 3	**Total number of place(s) available with supervisor:** 3

School: School of Molecular Sciences		
Main Supervisor: Dr Keith Stubbs		**Co-supervisor(s) :**
Project title:	**Development of scaffolds to inhibit carbohydrate-processing enzymes involved in biological processes**	
Lab/Group: Stubbs **Lab/Group Link:** https://research-repository.uwa.edu.au/en/persons/keith-stubbs		
Project description: The enzymes that regulate the structures of glycans (carbohydrates) are extremely important and have been implicated in a wide variety of diseases and thus are targets for therapeutics. The laboratory studies a wide variety of enzymes that have been implicated in a wide variety of diseases and biological processes. The project will be to design and synthesize a new inhibitor, that can then be used to investigate the role of a new carbohydrate-processing enzyme		
Required skills, knowledge or experience: Students interested in synthetic chemistry or synthetic chemistry & biochemistry are ideal for this project.		
Keywords: Carbohydrates, Synthesis, Inhibitors, Disease, Biological Function		
Supervisor Contact email: keith.stubbs@uwa.edu.au		
Project supervised: Face to Face Only		**Length of project:** 8 weeks
Total number of project(s) offered by supervisor: 1		**Total number of place(s) available with supervisor:** 1

School: School of Molecular Sciences	
Main Supervisor: Dr Monika Murcha	**Co-supervisor(s):**
Project title:	Labelling organelles with fluorescent tags
Lab/Group: Murcha Lab **Lab/Group Link:** murchalab.com	
Project description: This project will utilise both plant molecular techniques and fluorescent microscopy to generate and confirm transgenic lines with GFP/RFP/YFP labelled organelles. Mutant plants will be investigated to identify any changes to organelle numbers and dynamics. Furthermore, biolistic transformation of various organelle proteins will be carried out to determine protein localisations.	
Required skills, knowledge or experience: Lab safety and genetic handling online course	
Keywords: molecular biology, science, plants, microscopy, molecular science	
Supervisor Contact email: monika.murcha@uwa.edu.au	
Project supervised: Face to Face Only	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 2	**Total number of place(s) available with supervisor:** 3 (2 for this project)

School: School of Molecular Sciences		
Main Supervisor: Dr Monika Murcha		**Co-supervisor(s):**
Project title:	Identification of novel interacting partners	
Lab/Group: Murcha Lab **Lab/Group Link:** murchalab.com		
Project description: The TIM17/23/22 family of proteins have been shown to be involved in protein import mechanisms in mitochondria. They are also located in both mitochondria and chloroplast but for some, very little is known about their function. This project will utilise biochemical techniques to purify tagged protein from isolated mitochondria and chloroplasts to identify novel interacting partners via immunoprecipitation and mass spectrometry.		
Required skills, knowledge or experience: Lab safety and genetic handling online course		
Keywords: molecular science, plants, molecular biology, proteomics, science		
Supervisor Contact email: monika.murcha@uwa.edu.au		
Project supervised: Face to Face Only		**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 2		**Total number of place(s) available with supervisor:** 3 (1 for this project)

School: School of Psychological Science	
Main Supervisor: Dr Darja Kragt	**Co-supervisor(s):**
Project title:	**The future of leadership in the age of AI**
Lab/Group: Psychology at Work Lab	

Project description:

Project 1

This project aims to investigate how the advancement of artificial intelligence (AI) systems will change the nature of the workplace and, specifically, what impact this will have on leaders and managers. Anecdotal evidence suggests that managers are not fully prepared to integrate decision-making algorithms into their work practices, that is, managers refuse to take into account information and suggestions offered by algorithmic output, if it contradicts manager's own stance. This project hopes to investigate the different types of joint decision making and its impact on managerial decision making. Furthermore, personal and contextual characteristics that might impact manager's openness to AI input will be considered.

The student(s) will be involved in data collection and analysis.

Required skills, knowledge or experience:

Undergraduate major in psychology, business, engineering, computer science; quantitative research skills training.

Keywords: Leadership, artificial intelligence, decision making	
Supervisor Contact email: Darja.kragt@uwa.edu.au	
Project supervised: Both online and Face to Face	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 3	**Total number of place(s) available with supervisor:** 3

School: School of Psychological Science	
Main Supervisor: Dr Darja Kragt	**Co-supervisor(s):**
Project title:	**Leadership Behaviours and Outcomes**
Lab/Group: Psychology at Work Lab	

Project description:

Project 1

This project aims to identify emergent leadership behaviours, that is, behaviours that distinguish individuals who are acting as leaders versus non-leaders in groups. We have videotaped groups working on shared tasks and seek to understand which micro- and macro-behaviours help to identify leaders. The student will assist with rating the videos based on a pre-developed coding template.

Project 2

Leadership is seen as more challenging in volunteering context, because volunteers are free to leave organisation without penalty. Hence, leadership behaviours have different impact on outcomes in the volunteering context. In an attempt to better understand these behaviours and outcomes, we seek to conduct a systematic literature review on the topic. The student will assist with locating the relevant literature, and extracting information needed for the literature review.

Required skills, knowledge or experience:

Undergraduate major in psychology, sociology, business, etc.; qualitative or quantitative research skills training.

Keywords: Leadership behaviour, emergent leadership, volunteering	
Supervisor Contact email: Darja.kragt@uwa.edu.au	
Project supervised: Both online and Face to Face	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 3	**Total number of place(s) available with supervisor:** 3

School: School of Psychological Science

Main Supervisor: Dr Lynden Miles	**Co-supervisor(s):** Mrs Cathy Macpherson (PhD student)

Project title: **I'm virtually there: Exploring social interaction in immersive virtual environments**

Lab/Group: Social Influence Laboratory

Project description:

This project is focussed on the development and application of immersive virtual reality (VR) technology as a methodological tool for social psychological research. Although computer-mediated communication is becoming increasingly ubiquitous, very little research has considered how the quality and consequences of our social interactions are changed when we interact with others who are not physically present.

Project 1

In the study we are interested in how subtle non-verbal behaviours that support effective interactions in face-to-face settings (e.g., expressions, gestures, postural movements) impact the success of social exchanges that take place in VR. Specifically, we aim to: (i) compare coordination between participants' body movements when they interact in virtual and real-world environments; and (ii) understand whether this interpersonal coordination impacts social interaction differently in the virtual and real-world environments. Students will be involved with data collection and analysis.

Project 2

In this study we are interested in how an embodied sense of self (e.g., knowledge and awareness of one's own body) impacts the experience of immersion in virtual reality environments. Feeling immersed in a virtual environment is important for enhancing engagement and the quality of the experience. To date, much of the relevant research concerning immersion has been focused on the technical aspects of the experience (e.g., graphics resolution, head-set refresh rates). Here we aim to understand how accurate knowledge of the location and position of one's own body (i.e., an embodied sense of self) impacts the experience of immersion in virtual environments. Students will be involved with data collection and analysis.

Required skills, knowledge or experience:

Undergraduate major in Psychology, Cognitive Science or a related discipline; experience with data collection and collation with human participants; well-developed quantitative analysis skills.

Keywords: social psychology, virtual reality, coordination, embodiment

Supervisor Contact email: lynden.miles@uwa.edu.au

Project supervised: Face to Face only	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 2	**Total number of place(s) available with supervisor:** 2

School: School of Psychological Science	
Main Supervisor: Dr Nic Badcock	**Co-supervisor(s):**
Project title:	**Understanding Human Cognitive Potential**

Project description:

Project 1

The student/s will be involved in a series of research activities broadly exploring individual differences in human cognitive potential. For example, does a particular pattern of functional cerebral asymmetries make you a better learner? The specifics may be driven by the student interest. The elements include: data collection (likely behavioural; i.e., computer tasks and questionnaires; and potentially neurophysiology – EEG and/or fTCD – recordings, scoring/entry, and preliminary analysis to explore the cerebral lateralisation of verbal and non-verbal abilities. Responsibilities will include: familiarisation with the area of study; data collection, scoring, entry, and handling; and preliminary write-up for research publications. All of these activities will occur within a collaborative research environment: with communication over email, Zoom, and cloud file sharing (CloudStor) and online repositories (e.g., Open Science Framework). The student may also have the opportunity to observe and participate in pilot testing and/or data collection with Honours and PhD students.

EEG = electroencephalography

fTCD = functional transcranial Doppler ultrasound

Required skills, knowledge or experience:

Undergraduate experience and interest in psychology

Keywords: cognition, neurophysiology, human potential	
Supervisor Contact email: nicholas.badcock@uwa.edu.au	
Project supervised: Face to Face only	**Length of project:** Standard 8 weeks – could be extended for interested candidates
Total number of project(s) offered by supervisor: 1	**Total number of place(s) available with supervisor:** 2

School: School of Psychological Science	
Main Supervisor: Dr Simon Li	**Co-supervisor(s) :**
Project title:	**Making Artificial Intelligence (AI) generated advice understandable to humans**

Project description:

Many industries are adopting AI-assisted technology to generate predictions or advice to help with their decision-making process. For example, doctors may consult an AI system to help with diagnosis of disease. The AL algorithms that generate the predictions are usually complex and it makes understanding the workings of the algorithm difficult for humans. Yet, without such understanding, it is difficult for humans to develop an appropriate level of trust of AI. The challenge is to design user interfaces for AI-assisted technology to help explain how its advice is generated; the aim is to help humans develop an appropriate level of trust (not too much, not too little) of the technology. This project will explore the main issues in explainable AI (XAI) with a focus in healthcare technology. You will help with identifying the relevant and most up-to-date literature in the area and contribute to writing a systematic literature review. There is a possibility that you may help with data collection for an XAI experiment.

Required skills, knowledge or experience:

Undergraduate major in psychology, computer science, AI, or related disciplines. Interest or knowledge in human factors is a bonus.

Keywords: XAI, automation, human factors psychology, user interface design, and healthcare	
Supervisor Contact email: simon.li@uwa.edu.au	
Project supervised: Both online and Face to Face	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 1	**Total number of place(s) available with supervisor:** 1

School: School of Population and Global Health	
Main Supervisor: Prof Romola Bucks	**Co-supervisor(s):** Associate Professor Rebecca Glauert, Dr Juliana Zabatiero
Project title:	**The Raine Study – 30 years of longitudinal cohort data from pregnancy to adulthood**
Lab/Group: The Raine Study **Lab/Group Link:** www.rainestudy.org.au	
Project description: This is an exciting opportunity to complete your research internship with the Raine Study. The Raine Study, established in 1989, is one of the largest prospective cohorts of pregnancy, childhood, adolescence and adulthood to be carried out anywhere in the world. The Raine Study has grown to be a multi-generational study. We have followed a group of young adults from before they were born and throughout their life. Their families are also part of the study, with their children, their parents and their grandparents now also involved. The rich data collected on each Raine Study participant is being used by researchers all over the world to better understand, and improve, human health and quality of life. You will be offered the opportunity to shadow a wide range of Raine Study staff, and engage with different research and operational activities, in order to learn about how a longitudinal epidemiological study runs including how data are collected, how we communicate with and engage participants in our research, data cleaning and administration and research governance.	
Required skills, knowledge or experience: Postgraduate student or senior undergraduate or honours student preferred. Students with backgrounds in science communication, psychology, biology, human sciences, epidemiology, mental health, physiology, qualitative research skills, data sciences would be welcome. Student contribution: the exact details of the student's role will be worked out in consultation with the student and will depend on a) the skills they bring to the internship and b) what they are most interested in learning/developing whilst with us. The student will likely be involved in data management, analysis, research management, data entry/cleaning, writing about science for the general public (including for social media).	
Keywords: Epidemiology, mental health, physical health, sleep, science communication, research, data collection, cohort study	
Supervisor Contact email: romola.bucks@uwa.edu.au	
Project supervised: Face to Face only	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 1 (but it is very broad)	**Total number of place(s) available with supervisor:** 4

School: UWA School of Agriculture and Environment	
Main Supervisor: Dr Dominique Blache	**Co-supervisor(s): Prof Shane Maloney**
Project title:	**Getting to know flies**

Project description:

Drosophila melanogaster, the common fruit fly, is used as a model to study many biological processes. In our lab, we use *Drosophila* to study whether food supplements can mitigate the negative effects of high temperature on their reproduction, their activity, and their preference for different food supplements. Each experiment uses a large number of individual flies, and data acquisition and analysis by humans is very time consuming. This project aims to generate analytical tools to measure the activity of the flies across multiple days and nights, their preference for different foods, and the characteristics of their gametes. You will develop new algorithms to extract relevant data from a database of video recordings of flies and / or still photos of the gut content of flies, and their reproductive organs.

Required skills, knowledge or experience:

Image processing, programming language such as Python or C. Knowledge of image analysis software such as Fiji would be useful. No prior knowledge of Drosophila biology needed.

Keywords: Image processing, Data science	
Supervisor Contact email: dominique.blache@uwa.edu.au	
Project supervised: Both online and Face to Face	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 2	**Total number of place(s) available with supervisor:** 2

School: UWA School of Agriculture and Environment

Main Supervisor: Dr Parwinder Kaur	**Co-supervisor(s):**

Project title: **DNA Zoo Australia – Mapping Australia's Biodiversity**

Lab/Group: DNA Lab @UWA
Lab/Group Link: https://www.youtube.com/watch?v=9PniPYb2zsI&t=17s

Project description:

Project 1

With the climate emergency exacerbating natural disasters, as evidenced by the Australian wildfires having killed >1 billion animals, we have a very short time to characterize, record and support our unique biodiversity.

The project aims to:
- Contribute significantly to conservation of ecosystems under rapid environmental change, with unique 3D genomics to complete chromosome-genome assemblies critical for gene regulation studies, the key to understanding all species – plants, animals

- Develop an integrated system for data production and analysis and train scientific leaders with diverse skillsets that blend biology, applied mathematics, computational linear algebra and algorithm design

- Accelerate fundamental research with genomics to meet critical needs of conservation management of biodiversity, as identified by society, government and industry

Living on an island continent, Australian biota have evolved in isolation, which has given rise to Australia's unique biodiversity. All three lineages of mammals are found on the continent including monotremes (egg-laying), marsupials (pouched) and eutherians (placental) (Woinarski et al., 2015). Monotremes were the earliest diverging mammalian lineage and it is estimated marsupials and eutherians diverged ~150mya. Marsupials have a unique biology, giving birth to extremely under-developed young and having a complex lactation system. Genomic studies of marsupials are limited compared to eutherians. However, given their phylogenetic position and unusual biological features, genomic studies of marsupials have provided important insights into mammalian evolution, disease and development.

Remarkably, it is approximated that 87% of Australian terrestrial mammals are endemic. However, Australia has one of the highest recent rates of mammalian extinction in the world. Since European settlement over 10% of the 273 endemic terrestrial mammals have become extinct, with particularly high losses of marsupial species. A major driver of the decline of Australian mammals is thought to be the introduction of non-native species (Woinarski et al., 2015).

Required skills, knowledge or experience:

Advanced molecular biology OR bioinformatics skills are required

Keywords: Biodiversity, 3D Genomics, HiC, DNA Zoo

Supervisor Contact email: Parwinder.kaur@uwa.edu.au

Project supervised: Face to Face only	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 2	**Total number of place(s) available with supervisor:** 2

School: UWA School of Agriculture and Environment	
Main Supervisor: Dr Parwinder Kaur	**Co-supervisor(s):**
Project title:	**Exploration of alternative synthetic production platforms for bio-synthetic pathways using microbial cell factories**
Lab/Group: DNA Lab @UWA **Lab/Group Link:** https://www.youtube.com/watch?v=9PniPYb2zsI&t=17s	
Project description: **Project 2** An increasing world population augmented with fast industrialisation has significantly increased global energy consumption per capita. This increasing energy demand is being fulfilled by conventional non- renewable energy sources such as fossil fuels, which have limited untapped reservoirs, and are associated with environmental degradation and health issues. Many studies recently estimated that the demand for energy at its current speed is going to escalate 50% by 2030, demonstrating the urgent need for non-conventional, renewable and sustainable energy resources. Moreover, the demand for pharmaceutical proteins and other high value products is being fulfilled by industrial biotechnology by employing yeast, mammals and insects. Concepts and technologies provided by synthetic biology and biotechnology are inspiring and encouraging researchers to re-imagine bio-based materials.	
Required skills, knowledge or experience: Advanced molecular biology and microbiology skills are required	
Keywords: Microbiology, Synthetic Biology, Cell factories	
Supervisor Contact email: Parwinder.kaur@uwa.edu.au	
Project supervised: Face to Face only	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 2	**Total number of place(s) available with supervisor:** 2

School: The UWA Institute of Agriculture	
Main Supervisor: Prof Kadambot Siddique	**Co-supervisor (s):** Dr Jiayin Pang and Dr Yinglong Chen
Project title:	**Efficient root system for abiotic stress tolerance in crops**
Group: The UWA Institute of Agriculture - http://www.ioa.uwa.edu.au/	

Project description:

Project 1 and 2

Plant survival and fitness are dependent on root system architecture (RSA). In Australia, root systems of major agricultural crops are poorly adapted to soils that mostly have poor water holding capacity and nutrient deficiencies. Decreasing water availability due to drying and variable climate in the Australia's grain-belt exacerbates these soil-related stresses. Development of future crop genotypes with efficient root system for enhanced abiotic stress tolerance is essential for improved crop adaptation. Root traits that overcome abiotic constraints are critical to maintaining structural and functional properties, and are considered first order targets in breeding programmes for rainfed environments. Root traits, such as deep root systems, increased root density in subsoil, increased root hair length and density and / or xylem diameters, may contribute to enhanced water and nutrient uptake. Narrow-leafed lupin genotypes with increased capacity to take up water from deep soil horizons were linked to increased yield potential; similar relationship exists in wheat, soybean and upland rice.

Modification of RSA could contribute to improvements of desirable agronomic traits / such as yield, drought tolerance, and resistance to nutrient deficiencies. Wide-scale use of root / related genetic information in breeding programs relies on accurate phenotyping of relatively large mapping populations. Such large-scale phenotyping of root-related traits remain the most important issue in translating recent physiological and genetic advances in understanding the role of root systems in improved adaptation to abiotic stress and enhanced productivity of agricultural crops.

The candidate will be involved in measuring root systems of crop plants using some innovative / techniques during the project period.

Required skills, knowledge or experience:

Interest in undertaking plant based experiments in the glasshouse and controlled environment

Keywords: root system architecture, crop physiology, water and nutrient use efficiency

Contact email: kadambot.siddique@uwa.edu.au

Project supervised: Face to Face only	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 2	**Total number of place(s) available with supervisor:** 2

School: Engineering

Main Supervisor: Prof Gia Parish	**Co-supervisor(s):** A/Prof Adrian Keating / Prof Murray Baker

Project title: **A new material for energy conversion; nanoporous gallium**

Lab/Group: Advanced Quantum and Sensing Technologies/Microelectronics Research Group
Lab/Group Link: https://www.uwa.edu.au/research/advanced-sensing-and-quantum-technologies

Project description:

Project 1

Hydrogen generation from sunlight is of great interest to address climate change and energy security concerns. Gallium nitride (GaN) is a material that has been commercially applied to light emitting diodes, lasers, and high power transistors, but also has the ideal energy band and chemical stability properties for zero-bias hydrogen generation from solar energy applications and water splitting using sunlight (photoelectrolysis). Fabrication of nanoporous (NP) GaN allows for a tremendous increase in surface-to-volume allowing for much higher energy conversion efficiency of PEC reactions.

This project will assist in the development of a photoelectrochemical (PEC) etching process to fabricate NP-GaN from thin films, for future application to water splitting. The project is multi-faceted and you may work on aspects such as:

- Literature survey of published NP-GaN fabrication methods particularly for water splitting
- Consideration of safety aspects for undertaking PEC of GaN to create NP-GaN
- Adaptation of existing PEC equipment in our lab to fabricate NP-GaN OR building an entirely new PEC setup
- Implementing PEC of GaN to create NP-GaN
- Microscopy and optical measurement techniques to characterise the etched GaN.

Required skills, knowledge or experience:

Students are sought with backgrounds in chemistry, materials science, nanotechnology/nanoscience, electronic engineering, materials engineering, chemical engineering or physics.

Keywords: electrolysis, porous materials, nanotechnology, water splitting, hydrogen generation

Supervisor Contact email: giacinta.parish@uwa.edu.au

Project supervised: Face to Face Only	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 2	**Total number of place(s) available with supervisor:** 4

School: Engineering

Main Supervisor: Prof Gia Parish	**Co-supervisor(s):** Prof Brett Nener / Prof Murray Baker / Dr Matthew Myers (CSIRO)

Project title: **Transistor-based chemical sensors for monitoring water contaminants**

Lab/Group: Advanced Quantum and Sensing Technologies/Microelectronics Research Group
Lab/Group Link: https://www.uwa.edu.au/research/advanced-sensing-and-quantum-technologies

Project description:

Project 2

Reliable, economically accessible technology for in-situ monitoring of contaminants in water has the power to transform health, industry, and society the world around. Applications of such monitoring range from process control monitoring and optimisation for industry, to water supply quality and wastewater monitoring, to environmental monitoring for resource extraction, and beyond. One example is contamination of environmental water bodies with heavy metal pollutants which are known to be extremely toxic metals and can lead to an irreversible damage to the health of humans and animals. In pursuit of miniaturised, robust, and ultrasensitive sensors, we are developing ion-selective field effective transistors (ISFETs) for various chemical sensing applications. . We have demonstrated various sensors (pH and nitrate, mercury and calcium ions) and are currently investigating different methods to improve the sensitivity by varying the ion-selective functionalisation layer. We are also currently investigating ways to improve reliability by modifying packaging and measurement conditions. Elimination of drift will enable in situ, real-time contaminant monitoring that is accurate, reliable and low-cost.

Places are available for multiple students to work on one or more of the following integrated project components:

1. Physical, chemical, and materials characterisation of functionalisation methods for nitrates and heavy metals
2. Electrical, chemical, and physical characterisation and optimisation of functionalised sensors
3. Mechanical, electrical and chemical characterisation and optimisation of packaging techniques

Required skills, knowledge or experience:

Students are sought with backgrounds in electrical/electronic engineering, materials engineering, chemical engineering, chemistry, physics, materials science or nanotechnology/nanoscience. Prior studies/experience in semiconductor device technology or chemical sensors is desirable though not essential.

Keywords: Sensors, Transistors, Water, Environment, Chemical

Supervisor Contact email: giacinta.parish@uwa.edu.au

Project supervised: Face to Face Only	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 2	**Total number of place(s) available with supervisor:** 4

School: Engineering	
Main Supervisor: Prof Hui Tong Chua	**Co-supervisor(s):** Prof Andy Fourie
Project title:	**Bauxite residue remediation through centrifugation**
Lab/Group Link: https://research-repository.uwa.edu.au/en/persons/hui-chua	
Project description: This project is in collaboration with a local company, South32, which has kindly provided confidential data of the bauxite residue from Worsley alumina refinery, and bauxite residue for the experiments. The student will assist with conducting the experiments and analyse the data. The student will also participate in reporting to the company as to the implication to the refinery in terms of remediation of the bauxite residue, which is a huge liability to the industry. The student is required to sign a deed poll with UWA as he/she will be given access to confidential information.	
Required skills, knowledge or experience: The student should be from Mechanical or Chemical Engineering background and is familiar with using Excel spreadsheet.	
Keywords: Mechanical, Chemical, Engineering, Heat and Mass Transfer, Thermodynamics	
Supervisor Contact email: huitong.chua@uwa.edu.au	
Project supervised: Face to Face Only	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 1	**Total number of place(s) available with supervisor:** 6

School: Engineering	
Main Supervisor: Prof Thomas Braunl	**Co-supervisor(s):**
Project title:	**Autonomous Driving**
Lab/Group: Renewable Energy Vehicle Project (REV) **Lab/Group Link:** http://revproject.com	
Project description: We are working on a new autonomous vehicle, based on an electric shuttle bus. It is equipped with several sensor systems, including GPS, camera, Lidar, IMU (inertial measurement unit) and wheel encoders. The project operates as a student led team with support and mentorship from faculty, PhD students and industry professionals and has a strong history of academic publication. We are using the latest automotive control hardware with an Nvidia Jetson AGX Xavier system which provides real-time sensor processing and accelerated deep learning capabilities and currently utilise a Robot Operating System (ROS) based software stack with C++ and Python nodes. This project also includes high-reliability embedded systems and a hardware-in-the-loop simulation system for software development.	
Required skills, knowledge or experience: - Good programming experience in C++ or Python is required - Experience in Robot Operation System (ROS) is desirable	
Keywords: Autonomous driving, software design	
Supervisor Contact email: tb@ee.uwa.edu.au	
Project supervised: Face to Face only	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 1	**Total number of place(s) available with supervisor:** 4

School: Physics, Mathematics and Computing	
Main Supervisor: Prof David Coward	**Co-supervisor(s):** Bruce Gendre, Eric Howell
Project title:	**Simulating flares in the biggest explosions in the Universe**
Lab/Group: OzGrav UWA: multi-messenger astronomy	
Project description: Gama ray bursts (GRBs) are the biggest explosions in the Universe: are the result of massive stars collapsing to black holes or neutron stars colliding. This project combines real data from GRBs obtained by robotic telescopes and NASA satellites to test models for the source of unusual flaring observed in some GRB afterglows. The student will use simulations to test if these models could be sources of flaring in the high energy and optical emissions of GRBs.	
Required skills, knowledge or experience: Simulation will use python code. Statistical methods of simulating from PDF useful. Basic knowledge of gamma ray bursts from the literature.	
Keywords: astrophysics, gamma ray bursts, simulation	
Supervisor Contact email: David.coward@uwa.edu.au	
Project supervised: Both online and Face to Face	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 1	**Total number of place(s) available with supervisor:** 2

School: Physics, Mathematics and Computing	
Main Supervisor: Prof Enrico Valdinoci	**Co-supervisor(s): Prof Serena Dipierro**
Project title:	**Nonlocal Equations**
Project description: Understanding the regularity theory of nonlocal equations possibly in nonlinear cases. Detecting original boundary behaviours induced by the mass at infinity. Students will get acquainted with a hot and difficult topic of contemporary mathematical research. Students will enhance skills in mathematical analysis, differential equations and differential geometry. This project could lead to Honours/Master/PhD projects and potential publications.	
Required skills, knowledge or experience: Calculus and Mathematical Analysis	
Keywords: integrodifferential equations, regularity theory	
Supervisor Contact email: enrico.valdinoci@uwa.edu.au	
Project supervised: Both online and Face to Face	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 2	**Total number of place(s) available with supervisor:** 2

School: Physics, Mathematics and Computing	
Main Supervisor: Prof Enrico Valdinoci	**Co-supervisor(s):** Prof Serena Dipierro
Project title:	**From discrete to continuous equations**

Project description:

Recover partial differential equations and integrodifferential equations as a limit of discrete models (spin systems, games of life, etc.).

Students will analyse the relations and differences between discrete and continuous models and transfer knowledge from one to the other. These type of problems are relevant also in the analysis of population dynamics and atom dislocation in crystals.

Students will enhance skills in mathematical analysis, differential equations, mathematical biology and mathematical physics. This project could lead to Honours/Master/PhD projects and potential publications.

Required skills, knowledge or experience:

Calculus and Mathematical Analysis

Keywords: Discrete and continuous mathematical models	
Supervisor Contact email: enrico.valdinoci@uwa.edu.au	
Project supervised: Both online and Face to Face	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 2	**Total number of place(s) available with supervisor:** 2

School: Physics, Mathematics and Computing

Main Supervisor: Prof Chunnong Zhao	**Co-supervisor(s):** Prof Li Ju / Dr Xu Chen

Project title: **Optical Springs and Optical Dilution —Beating the Standard Quantum Limit**

Lab/Group: Gravitational Wave Detector Instrumentation Group, Physics
Lab/Group Link: http://gravity.uwa.edu.au

Project description:

Gravitational wave instrumentation research in Australia began at UWA, where we pioneered one of the world's first high sensitivity resonant mass gravitational wave detectors. Today our research is focused on the development of advanced techniques to improve the sensitivity of gravitational wave detectors.

Our team is part of the LIGO Scientific Collaboration (LSC) and contributed some key technologies towards the first detection of the gravitational waves. We are part of the ARC centre of Excellence for Gravitational Wave Discovery (OzGrav). Our research areas include precision measurement, quantum optics, high optical power suspended cavities, advanced vibration isolation techniques and control systems. The research is exploring exciting new physics phenomena and techniques that have applications beyond gravitational wave detectors, including quantum measurement technologies and airborne exploration devices.

A specific area of research explores new concepts in amplification and measurement based on the interactions between optical photons and acoustic phonons. Devices based on this frontier of measurement technology require very low loss opto-mechanical systems in which light and sound (or mechanical vibration) interact very strongly without being contaminated by thermal fluctuations. We are testing and inventing many novel opto-mechanical resonators, including nano-scale optical pendulums made from synthetic crystalline mirrors, others made from photonic and phononic crystals, and some made from ultrapure crystals of quartz. With these devices we observe and predict many new phenomena such as optical springs, optical dilution, optomechanically induced transparency, frequency dependent optical squeezing, negative dispersion and white light resonance. The phenomenon of white light resonance (that violates the normal theory of resonance) offers enormous opportunities for improving the sensitivity of gravitational wave detectors, which in turn will allow new astrophysical phenomena to be explored.

This project will involve simulating various mechanical micro-resonators using Finite Element Modelling software (ANSYS or COMSOL), characterising the mechanical and optical properties of the micro-resonators, as well as tuning and testing the opto-mechanical interactions with the resonators inside an optical cavity.

We are a vibrant, friendly and international group. We welcome highly motivated students to join us.

Required skills, knowledge or experience:

Student should have
-Basic knowledge of optics, such as Gaussian beams, optical cavities. Many of the basic concept of the optics could be easily found online.
-Mechanical resonator, frequency domain
-Some skill of comment computer software such as Matlab, and a fast learner to use different computational package.

Keywords: Optical Experimentation and simulation

Supervisor Contact email: li.ju@uwa.edu.au

Project supervised: Face to Face Only	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 1	**Total number of place(s) available with supervisor:** 2

School: Physics, Mathematics and Computing

Main Supervisor: Prof Li Ju	**Co-supervisor(s):** Prof Chunnong Zhao

Project title: Simulation of Parametric Instability for advanced Gravitational Wave Detectors

Lab/Group: OzGrav Instrumentation
Lab/Group Link: https://www.gravity.uwa.edu.au/ https://www.ozgrav.org/

Project description:

Since the first detection of the gravitational wave in 20-15, there are great effort to make the detectors more sensitive. High laser power inside the detector optical cavities will reduce the shot noise but would have the potential of causing parametric instability. The UWA team has been investigating methods for controlling parametric instability. This project is to use computer simulation tools (such as finite element modelling, cavity analysis and MatLab) to study the effect of parametric instability for the proposed upgrade of the advanced gravitational wave detectors.

Required skills, knowledge or experience:

Skills: be able to use the below software or a fast, confident learner for software operation

- Finite element modelling (Comsol)
- MatLab

General knowledge:

- optical cavity and cavity resonant modes
- normal modes of a mechanical object/system

Keywords: gravitational wave detector techniques, finite element modelling

Supervisor Contact email: li.ju@uwa.edu.au

Project supervised: Online	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 4	**Total number of place(s) available with supervisor:** 8

School: Physics, Mathematics and Computing	
Main Supervisor: Prof Li Ju / Dr John Winterflood	**Co-supervisor(s):** Prof Li Ju and Mr Joshua McCann (PhD student)
Project title: **Tilt/Rotation Sensor**	
Lab/Group: Gravitational Wave Detector Instrumentation Group **Lab/Group Link:** http://www.gravity.uwa.edu.au https://www.ozgrav.org/	
Project description: The detection of gravitational waves started a new era of gravitational wave astronomy. It is the fastest growing field of astronomy as we discover more and more sources of gravitational waves across the universe. The improvement of detectors, and development of new detectors is crucial for the field to continue to advance. We are building a very sensitive tilt/rotation sensor and feedback systems to actively suppress the ground tilts to improve the low frequency performance of gravitational wave detectors. Traditional inertial sensors could not distinguish tilt and horizontal motion. Our tilt/rotation sensor incorporate many innovative design such as cross flexure to enable arbitrary mounting angle, magnetic anti-spring to reduce the resonant frequency and precision optical walk-off interferometric readout system. The student will participate in the characterisation of the instrument (both mechanical system and optical readout system), as well as any upgrade/improvement design. This project suits both Physics students and Engineering students. We are part of the national ARC Centre of Excellence for Gravitational Wave Discovery (OzGrav). Our team is part of the LIGO Scientific Collaboration (LSC) and contributed some key technologies towards the first detection of the gravitational waves. We are a vibrant, friendly and international group. We welcome highly motivated students to join us.	
Required skills, knowledge or experience: -Basic vibration isolation knowledge -Some CAD drawing skill would be preferable	
Keywords: Precision sensing, vibration isolation	
Supervisor Contact email: li.ju@uwa.edu.au	
Project supervised: Face to Face Only	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 4	**Total number of place(s) available with supervisor:** 8

School: Physics, Mathematics and Computing

Main Supervisor: Prof Li Ju / Dr Joris van Heijningen

Co-supervisor(s): Prof Li Ju

Project title: **Generating error signals for cavity mode matching**

Lab/Group: Gravitational Wave Detector Instrumentation Group
Lab/Group Link: http://gravity.uwa.edu.au

Project description:

The theory of General Relativity, published by Albert Einstein in 1915, describes gravity as the curvature of space-time. Einstein realised soon after publishing that his theory produces wave solutions. Gravitational waves (GW) are minute ripples in the curvature of space-time that are produced by violent astrophysical events. They propagate through space at the speed of light like the waves in a pond after a pebble is thrown onto its surface. Because the curvature of space-time and gravity are interconnected, a gravitational wave will change the way freely falling objects fall with respect to each other. We can therefore measure gravitational waves by accurately monitoring the apparent motion of suspended test masses, which is done by using kilometre-scale laser interferometers. After the first detection in September 2015, we are now detecting GW on a weekly basis. The study of gravitational waves has opened up a whole new window on the Universe and we are discovering something new almost on a weekly basis!

Part of the instrumentation section of our group focuses on the high frequency part of improvements to the overall sensitivity curve of the detector collaboration we are a part of: LIGO, two 4-km-arm interferometers in the USA. The strain sensitivity to be reached at design sensitivity of Advanced LIGO nears the 1×10-24 1/√Hz level in the most sensitive frequency range. Minimising any optical losses in a gravitational wave detector is important if advanced techniques, such as squeezing or the white light cavity, are to be fruitful. When input beam waist position and/or size are not matched to those of the cavity, we speak of mode mismatch. Mode mismatch is a source of optical loss and therefore we need error signals to control it to a minimum.

This project combines optical design and experiment towards a novel mode matching control technique, which could be used in GW detectors all around the world in the future. You will simulate the proposed set-up in Finesse, an optical simulation tool used in the GW community. In this simulation you will, for instance, will determine the position and preferred characteristics of all optical components. You will then help build this optical set-up to validate its performance.

Learning goals:
- How GW are measured and why mode matching is necessary;
- Advantages and limitations of the proposed solution;
- Design of optical systems and subsequent simulation of these designs;
- Characterisation of prototype optical systems.

Required skills, knowledge or experience:

General data analysis tools, e.g. Python, Matlab, Mathematica or similar.

Keywords: Gravitational Waves, Optical experiment, Optical simulation

Supervisor Contact email: li.ju@uwa.edu.au

Project supervised: Face to Face Only	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 4	**Total number of place(s) available with supervisor:** 8

School: Physics, Mathematics and Computing

Main Supervisor: Prof Li Ju	**Co-supervisor(s):** Dr. Carl Blair, Harmid Satari PhD Candidate

Project title: **Seismic Imaging Array**

Lab/Group: Gravitational Wave Detector Instrumentation Group
Lab/Group Link: http://www.gravity.uwa.edu.au
https://www.ozgrav.org/

Project description:

The detection of gravitational waves started a new era of gravitational wave astronomy. It is the fastest growing field of astronomy as we discover more and more sources of gravitational waves across the universe. The improvement of detectors, and development of new detectors is crucial for the field to continue to advance.

To improve the low frequency sensitivity, it is necessary to study the seismic environment around the detectors. We are building a seismic array network around our Gingin research centre where we have an 80m long suspended high power optical cavity. By correlate array data, we could get information about surface wave direction, speed ect, and would help to create the seismic waves "image". This information could be used either in feedback control of the vibration isolation system for the detectors, or in detector signal data analysis. This project will involve deploy low frequency seismometers, collect and analyse array data.

This project suits both Physics students and Engineering students. We are part of the national ARC Centre of Excellence for Gravitational Wave Discovery (OzGrav). Our team is part of the LIGO Scientific Collaboration (LSC) and contributed some key technologies towards the first detection of the gravitational waves.

We are a vibrant, friendly and international group. We welcome highly motivated students to join us.

Required skills, knowledge or experience:

-Basic vibration isolation knowledge
-Some knowledge on data analysis such as cross correlation, Fourier analysis

Keywords: Seismic motion, Data Analysis

Supervisor Contact email: li.ju@uwa.edu.au

Project supervised: Face to Face Only (85% on campus and a few days at Gingin site)	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 4	**Total number of place(s) available with supervisor:** 8

School: Physics, Mathematics and Computing	
Main Supervisor: Prof Linqing Wen	**Co-supervisor(s) :**
Project title:	**Pre-merger detection of gravitational waves**
Project description: The project aims at detecting and localising gravitational waves from the inspiral of two compact objects before their final merger for early warnings of gravitational wave events. The students will help with the implementation and testing of the search methods.	
Required skills, knowledge or experience: Proficient in C or Python programming language	
Keywords: gravitational wave, astronomy, detection, data analysis, signal processing, early warning, multi-messenger, simulation	
Supervisor Contact email: linqing.wen@uwa.edu.au	
Project supervised: Both online and Face to Face	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 2	**Total number of place(s) available with supervisor:** 2

School: Physics, Mathematics and Computing	
Main Supervisor: Prof Linqing Wen	**Co-supervisor(s) :**
Project title:	**Search for Electromagnetic Counterparts of Gravitational Wave Events**
Project description: The project aims searching for electromagnetic counterparts of gravitational wave events. The students will conduct searches in available astronomical databases for fast radio bursts (and possibly gamma-ray burst) counterparts of gravitational waves.	
Required skills, knowledge or experience: Astronomy, comfortable with writing C/python/Unix-shell scripts	
Keywords: gravitational wave, astronomy, detection, data analysis, signal processing, early warning, multi-messenger, simulation	
Supervisor Contact email: linqing.wen@uwa.edu.au	
Project supervised: Both online and Face to Face	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 2	**Total number of place(s) available with supervisor:** 2

School: Physics, Mathematics and Computing		
Main Supervisor: Prof Linqing Wen		**Co-supervisor(s) :**
Project title:	**Using Gravitational Wave Events to Probe our Universe**	
Project description: The project aims at a feasibility study of using detected GW events to probe our Universe. The students will use available GW database and simulations to measure the spatial distribution of GW sources and then study its implications to our understanding of the matter distribution and geometry of our Universe.		
Required skills, knowledge or experience: Astronomy, comfortable with Bayesian statistics and with writing C/python/Unix-shell scripts		
Keywords: gravitational wave, astronomy, data analysis, signal processing, simulation		
Supervisor Contact email: linqing.wen@uwa.edu.au		
Project supervised: Both online and Face to Face		**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 1		**Total number of place(s) available with supervisor:** 1

School: Physics, Mathematics and Computing		
Main Supervisor: Prof Michael Small		**Co-supervisor(s):** Dr Correa, Dr. Zaitouny
Project title:	**Machine learning and predictive maintenance**	
Lab/Group: Complex Systems, ARC Training Centre of Transforming Maintenance through Data Science. CSIRO		
Project description: **<u>Project 1:</u>** **This proposal can accommodate multiple students** Machine learning and dynamical systems techniques will be applied to study and augment predictions of failure of machinery. Specifically, predictive maintenance is the schedule of maintenance tasks based on predictions of imminent or likely failure. Machine learning based on historical data will be applied to augment this. Dynamical systems techniques based on the ideas of tipping points will be used to quantify likely onset of failure.		
Required skills, knowledge or experience: Advanced mathematics (dynamical systems, complex systems, topology, would all be advantageous), scientific programming (at least one of Julia, python, Matlab, Mathematica or R).		
Keywords: Complex Systems, Dynamical Systems, Chaos, Topology		
Supervisor Contact email: michael.small@uwa.edu.au		
Project supervised: Face to Face Only		**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 2		**Total number of place(s) available with supervisor:** 4(2 for this project)

School: Physics, Mathematics and Computing	
Main Supervisor: Prof Michael Small	**Co-supervisor(s):** Dr Shannon Algar and Dr Walker
Project title:	**Persistent homology of complex networks**
Lab/Group: Complex Systems	

Project description:

Project 2:

This proposal can accommodate multiple students

Techniques exist to represent dynamical systems observed through time series data as complex networks. These networks have a complicated variegated structure which encodes specific features of the underlying deterministic dynamics. The aim of the project is to apply techniques from computational topology to quantify these features and thereby link that quantification to the original (and interesting) dynamics. For example, chaotic dynamics generates particular structures in the network and persistent homology is to be employed to characterise the scale-dependent features of those structures. This will link quantities such as Lyapunov exponents and entropy to the rate of growth of topological properties.

Required skills, knowledge or experience:

Advanced mathematics (dynamical systems, complex systems, topology, would all be advantageous), scientific programming (at least one of Julia, python, Matlab, Mathematica or R).

Keywords: Machine Learning, Dynamical Systems, Predictive Maintenance	
Supervisor Contact email: michael.small@uwa.edu.au	
Project supervised: Face to Face Only	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 2	**Total number of place(s) available with supervisor:** 4(2 for this project)

School: Physics, Mathematics and Computing	
Main Supervisor: Prof Michael Tobar	**Co-supervisor(s):**
Project title:	**Investigation of 3D printed and taped superconducting resonators**
Lab/Group: Centre of Excellence for Engineered Quantum Systems **Lab/Group Link:** https://equs.org/fml	
Project description: **Project 1** The aim of this project is to advance the new discipline of 3D Printed superconducting technologies. Currently, the application of advanced superconductors is being hampered by our inability to produce complex geometries from materials with adequate superconducting properties. The intended outcome of this project is the ability to design the next generation of superconductors, along with the knowledge of how to produce them using metal 3D Printing. The ability to manufacture geometric complex, bulk superconducting structures with tuneable magnetic characteristics will lead to significant advances in many practical applications including dark matter detection and quantum computing. In particular this project will test various resonant structures, at 4K and mK and test the response to external magnetic fields. There is also the possibility we will implementing resonators with surfaces made from superconducting tape.	
Required skills, knowledge or experience: Physics or Electrical Engineering Major	
Keywords: Superconductors, 3D printing, Low temperature physics	
Supervisor Contact email: michael.tobar@uwa.edu.au	
Project supervised: Face to Face Only	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 3	**Total number of place(s) available with supervisor:** 3

School: Physics, Mathematics and Computing	
Main Supervisor: Prof Michael Tobar	**Co-supervisor(s):**
Project title:	**Search for Axion Dark Matter**
Lab/Group: Centre of Excellence for Dark Matter **Lab/Group Link:** https://www.darkmatter.org.au/ and https://equs.org/fml	
Project description: **Project 2** This project will assist the research group in the quest to search for axion dark matter. The axion is a particle that is believed to exist to solve the strong CP problem on why the neutron has no dipole moment even though it is made of charged quarks. The axion should also be produced in the early universe, and because it interacts very weakly with matter, the particle is a leading candidate to explain cold dark matter. To try and detect the axion we use the weak coupling to photons and novel microwave resonators and electronics at low temperatures to enhance the signal. This project will involve contributing to developing these devices under the umbrella of the ORGAN experiment which will search for cold dark matter in a range predicted by theorists.	
Required skills, knowledge or experience: Physics and Electrodynamics	
Keywords: Axion, Dark Matter, Precision Measurements, Low Temperature Physics	
Supervisor Contact email: michael.tobar@uwa.edu.au	
Project supervised: Face to Face Only	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 3	**Total number of place(s) available with supervisor:** 3

School: Physics, Mathematics and Computing

Main Supervisor: Prof Michael Tobar	**Co-supervisor(s):**

Project title: **Cryogenic Crystal for the Detection of WIMP Dark Matter**

Lab/Group: Centre of Excellence for Engineered Quantum Systems
Lab/Group Link: https://equs.org/fml; https://www.darkmatter.org.au/

Project description:

Project 3

Weakly interacting massive particles (WIMPs) are hypothetical particles that are thought to constitute dark matter. Broadly, a WIMP is a new elementary particle which interacts via gravity and any other force (or forces), potentially not part of the standard model itself, which is as weak as or weaker than the weak nuclear force, but also non-vanishing in its strength. A WIMP must also have been produced thermally in the early Universe, similarly to the particles of the standard model according to Big Bang cosmology, and usually will constitute cold dark matter. Typically experiments to detect WIMP dark matter are at energy/mass scales of 100 GeV, however due to the lack of success in detection experiments are expanding towards techniques to search for lower energy particles. This project will focus on new methods to implement crystal detection technology.

Cryogenic crystal detector techniques are currently used by a range of experiments, including the Cryogenic Dark Matter Search (CDMS) detector at the Soudan Mine. This detector relies on multiple very cold germanium and silicon crystals. The crystals (each about the size of a hockey puck) are cooled to about 50 mK. A layer of metal (aluminium and tungsten) at the surfaces is used to detect a WIMP passing through the crystal. This design hopes to detect vibrations in the crystal matrix generated by an atom being "kicked" by a WIMP. The tungsten transition edge sensors (TES) are held at the critical temperature so they are in the superconducting state. Large crystal vibrations will generate heat in the metal and are detectable because of a change in resistance. CRESST, CoGeNT, and EDELWEISS run similar setups but with a range of different crystals.

This project will cool such detector crystals to low temperatures, to study the electromagnetic properties at microwave frequencies from room temperature to low temperatures. It is envisaged by measuring the properties of the crystal that heating and phonon effects may be measured more accurately than before, allowing a breakthrough in improved sensitivity. At low temperatures a range of very interesting condensed matter physics also occurs. The project will include the investigation of this physics.

Required skills, knowledge or experience:

Physics or Electrical Engineering Major

Keywords: WIMPs, Crystal resonators, Low Temperature Physics, Dark Matter

Supervisor Contact email: michael.tobar@uwa.edu.au

Project supervised: Face to Face Only	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 3	**Total number of place(s) available with supervisor:** 3

School: Physics, Mathematics and Computing	
Main Supervisor: Dr Pejman Rowshan Farzad	**Co-supervisor(s):**
Project title:	**Designing an interface for a programmable 3D motorized platform**
Lab/Group: Medical Physics **Lab/Group Link:** www.uwamedicalphysics.org	
Project description: The aim of this project is to create a robust GUI for a Zaber 3D Robotic platform. The 3D motorized platform is used to move the patient to correct position and compensate for internal organ motions during radiotherapy. The software code receives input data provided in different formats, opens and reads files and extracts important parameters such as amplitude, angle and time. The data conversion system converts these parameters into x, y and z coordinates which can be accessed and utilized by other systems. These commands will be passed to the communication system to interact with the hardware and cause hardware movements to the expected position.	
Required skills, knowledge or experience: Programming skills: Matlab or Python. Familiar with making GUIs.	
Keywords: Robotics, Programming, 3D	
Supervisor Contact email: pejman.rowshanfarzad@uwa.edu.au	
Project supervised: Face to Face only	**Length of project:** 8 weeks
Total number of project(s) offered by supervisor: 1	**Total number of place(s) available with supervisor:** 2

School: Physics, Mathematics and Computing		
Main Supervisor: Prof Serena Dipierro		**Co-supervisor(s):** Prof Enrico Valdinoci
Project title:	**Isolated singularities for (non)local minimal surfaces**	

Project description:

Understanding under which conditions (non)local minimal surfaces can be smoothly extended beyond possible singularities.

Classical works have been done in E. De Giorgi, G. Stampacchia [Atti Accad. Naz. Lincei Rend. Cl. Sci. Fis. Mat. Nat. 38 (1965), 352–357] and, for the planar case, in J. Nitsche [Bull. Amer. Math. Soc. 71 (1965), 195-270].

Understanding the formation of singularity in geometric objects is one of the most challenging topics in mathematics and the project will aim at discovering new features also related to the nonlocal character of the minimisers of the fractional perimeter.

Students will enhance skills in mathematical analysis, differential equations and differential geometry. This project could lead to Honours/Master/PhD projects and potential publications.

Required skills, knowledge or experience:

Calculus and Mathematical Analysis

Keywords: (non)local minimal surfaces, regularity theory	
Supervisor Contact email: serena.dipierro@uwa.edu.au	
Project supervised: Both online and Face to Face	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 2	**Total number of place(s) available with supervisor:** 2

School: Physics, Mathematics and Computing	
Main Supervisor: Prof Serena Dipierro	**Co-supervisor(s):** Prof Enrico Valdinoci
Project title:	**Biological models in environments with climate change**

Project description:

Understanding the dynamics of biological populations when the corresponding environmental niche is changing with time. Finding sufficient conditions for the survival of the population and determine precise asymptotic regimes.

The problem is motivated by concrete applications related to climate change and conservation biology.

Students will enhance skills in mathematical analysis, differential equations, mathematical physics and mathematical biology. This project could lead to Honours/Master/PhD projects and potential publications.

Required skills, knowledge or experience:

Calculus and Mathematical Analysis

Keywords: Mathematical biology, population dynamics	
Supervisor Contact email: serena.dipierro@uwa.edu.au	
Project supervised: Both online and Face to Face	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 2	**Total number of place(s) available with supervisor:** 2

School: Physics, Mathematics and Computing	
Main Supervisor: Dr Vincent Wallace	**Co-supervisor(s):** Dr Tony Fitzgerald / Dr Sergii Romanenko
Project title:	**Terahertz Biomedical applications**
Lab/Group: http://www.physics.uwa.edu.au/research/terahertz	

Project description:

Project 1 and 2

Terahertz (THz) typically refers to the electromagnetic waves with the frequency ranging from 0.1 to 10 THz and the wavelength is between 30 to 3000 □m. Due to the lack of coherent sources, these frequencies, situated in the spectrum regime between optical and electronic techniques, were referred to as a THz gap. Nowadays, more and more techniques have been investigated to bridge this gap, and the applications of Terahertz cover a wide range from astronomy, security check to chemical and biomedical applications. Terahertz is strongly attenuated by water, thus very sensitive to the change of water content in biological tissues. Unlike X-ray, the photon energy of terahertz is very low that it does not pose any ionization hazard for human beings. Moreover, some collective inter-molecular vibrational modes lie in the terahertz frequencies. These unique features have made it a potential tool in biomedical research field. The student will work with a team of researchers on developing THz technology for biomedical applications which can involve data collection and processing, development of analysis and software interfaces.

Required skills, knowledge or experience:

Background: Students with electronics, physics, biomedical engineering or other related backgrounds are welcomed.
Skills: General knowledge in electromagnetic wave theory, physics and optics, signal processing, MATLAB or other coding language.

Keywords: terahertz, physics, biology, medical, biomedical	
Supervisor Contact email: vincent.wallace@uwa.edu.au	
Project supervised: Both online and Face to Face	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 2	**Total number of place(s) available with supervisor:** 2

School: Physics, Mathematics and Computing		
Main Supervisor: Dr Zijun C. Zhao		**Co-supervisor(s):** Prof Michael E. Tobar
Project title:	**Low temperature electromagnetic characterization of crystals and defects**	
Lab/Group: The Quantum Technologies and Dark Matter Lab		
Project description: Students will help analyse data used to characterise resonance systems based on novel crystals and their defects. This includes but is not limited to pre-obtained temperature dependent transmission data, along with the development and improvement of algorithms (possibly via machine learning) to auto fit Fano resonance and find the temperature dependent quality factor for characterising properties of crystals. The student also will get a chance to model the novel cavity in COMSOL and measure the cavity experimentally depending on the progress of the project. Students will enhance skills in Python programming for data analysis and instrument control, Finite element simulation in COMSOL, microwave measurements in room temperature and cryogenic temperature. This project could lead to Honours/Master/PhD projects and potential publications.		
Required skills, knowledge or experience: *Students major in physics, engineering, or math with strong programming skills and persistent interest in science*		
Keywords: low-temperature measurement, finite element simulation, microwave properties, machine learning		
Supervisor Contact email: cindy.zhao@uwa.edu.au, *michael.tobar@uwa.edu.au*		
Project supervised: Both online and Face to Face		**Length of project:** 8 weeks
Total number of project(s) offered by supervisor: 1		**Total number of place(s) available with supervisor:** 2

School: International Centre for Radio Astronomy Research	
Main Supervisor: Prof Kenji Bekki	**Co-supervisor(s) :**
Project title:	**Deep learning for classifying the synthesized images of galaxies from computer simulations**
Project description: Learning is classifying. Therefore, classifying galaxies can lead us to learn important aspects of galaxy formation and evolution. In this project, students will try to develop a new convolution neural network (CNN) to classify the synthesized images of galaxies produced by high-resolution computer simulations of galaxies. First, students in this project will use a million of synthesized galaxy images to train the CNN for an automated classification of galaxies. Then they will classify the observed images of galaxies from telescopes using the trained CNN in an automatic way. This novel galaxy classification scheme will be able to be used for real scientific research to discover something new (e.g., new discovery of hidden spiral arm structures, massive black holes, and dark matter etc).	
Required skills, knowledge or experience: Programming skills of Python and Keras/Tensorflow (AI libraries) and some basic knowledge / about deep learning are required.	
Keywords: Artificial intelligence (AI), astronomy, computer simulations	
Supervisor Contact email: kenji.bekki@uwa.edu.au	
Project supervised: Both online and Face to Face	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 1	**Total number of place(s) available with supervisor:** 3

School: International Centre for Radio Astronomy Research	
Main Supervisor: Dr Luca Cortese	**Co-supervisor(s):** A/Prof. Barbara Catinella, Dr. Amelia Fraser-McKelvie
Project title:	**A panchromatic view of galaxy evolution**
Lab/Group: International Centre for Radio Astronomy Research **Lab/Group Link**: https://www.icrar.org/ https://corteseluca.wordpress.com/	

Project description:

One of the most outstanding challenges in extragalactic astronomy is to identify the astrophysical processes responsible for transforming simple dark matter haloes into the heterogeneous population of galaxies inhabiting today's Universe. How did different morphological types form and evolve? Does the environment where a galaxy lives influence its evolution? Inevitably, the answers to these questions entail a detailed investigation of all the components of the interstellar medium (gas, dust, metals) and their relation to stellar properties, kinematics and environment. This clearly requires multi-frequency information (e.g., including ultraviolet, optical, infrared and radio observations) for statistically significant samples of galaxies across the cosmic web, which are becoming available only now.

Our research group investigates the physical properties of galaxies and their dependence on redshift and environment using large, multi-wavelength datasets. The multi-wavelength approach is at the foundation of our research, as it is the only way to trace all the baryonic constituents of galaxies and to reveal how the Universe formed and evolves.

We offer projects spanning a wide range of topics, and taking advantage of observations obtained with state-of-the-art ground- and space-based facilities. The expectation is that, during this internship, the student will gain the ability of handling and analyzing multi-frequency observations of galaxies, with specific focus on state-of-the-art integral field spectroscopic observations, providing a 3D view of the distribution and kinematics of stars, gas and metals in galaxies (e.g., SAMI, MANGA). S/he may also be involved in the publications of the project results on refereed journals in the field. In particular, the student will have the opportunity to work on on-going projects aimed at understanding the physical processes regulating the star formation activity of galaxies and the interplay between galaxy kinematics and visual morphology.

Required skills, knowledge or experience:

Basic knowledge of observational extragalactic astronomy (e.g., completion of introductory unit to galaxies). Basic experience in handling astronomical observations (e.g., use of ds9/SAOImage and knowledge of FITS format). Basic programming knowledge with Python or R (i.e., ability to produce plots). Basic knowledge of statistical methods and their application to large datasets.

Keywords: Galaxies, Star formation, Telescopes, Big data	
Supervisor Contact email: luca.cortese@uwa.edu.au	
Project supervised: Both online and Face to Face	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 1	**Total number of place(s) available with supervisor:** 2

School: Oceans Graduate School

Main Supervisor: Dr Arnold van Rooijen	**Co-supervisor(s):** Prof Ryan Lowe, Mario Conde-Frias

Project title: **Wave and current dynamics in submerged vegetation canopies**

Lab/Group: Coastal and Offshore Engineering Laboratory
Lab/Group Link: https://www.uwa.edu.au/ems/centres/coel

Project description:

It is well known that marine ecosystems (e.g., seagrass meadows, mangrove forests etc.) can cause substantial dissipation of energy of waves travelling towards the coast, and slow down currents driven by wind, tide and river flows. However, some of the detailed physical processes around the interaction between waves and vegetation canopies are relatively poorly understood and will be investigated in this project.

Project 1 (experimental, back-up: numerical)
Many marine ecosystems are situated in areas with not only wave influences but also currents (e.g. generated by the tide or river flow). Researchers have found that an underlying current can have great effects on how much wave energy is dissipated, but measurements have been very scarce. Therefore, this project aims to collect measurements of wave heights across a submerged canopy with and without an underlying current. The student will have a leading role in an experiment in the recently established Coastal and Offshore Engineering Lab. It is envisioned this project will be mainly carried out in the laboratory, but if physical experimentation is not feasible (e.g., due to the student being overseas), the work will be carried out using a detailed numerical model (SWASH).

Project 2 (numerical)
The presence of a vegetation canopy has a great influence on the transport of sediment (e.g. sand). One of the reasons is that the flow dynamics near the bottom are expected to change. In this project, the student will use a detailed numerical model (SWASH) to study the flow in the area close to the bottom (boundary layer) and how this changes for different vegetation canopies. It is expected that the results will provide important insights into how sediment may be eroded, deposited and transported within marine ecosystems.

Required skills, knowledge or experience:

- Basic programming skills (e.g., MATLAB, Python)
- Background in wave dynamics / coastal engineering (preferred)
- Experience with numerical modelling (preferred if using SWASH)

Keywords: Coastal engineering, nature-based solutions, waves, numerical modelling

Supervisor Contact email: arnold.vanrooijen@uwa.edu.au

Project supervised: Both online and Face to Face	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 2	**Total number of place(s) available with supervisor:** 2

School: Oceans Graduate School	
Main Supervisor: Prof C Pattiaratchi	**Co-supervisor(s):**
Project title:	**Ocean drifter data analysis I**
Lab/Group: Coastal Oceanography **Lab/Group Link:** https://www.web.uwa.edu.au/coastal-oceanography	
Project description: **Project 1** The Coastal Oceanography have been deployed surface current drifters along the West Australian coast over the past 12 months more than 50 drifters have been deployed. Ocean drifters have a GPS locator that transmits their location every 5 minutes and from this information, we can track the paths of the drifters and calculate velocities. Surface drift patterns are used to define ocean circulation at the surface and used to define pathways of buoyant material such as plastics. The student(s) will be able to use selected ocean drifter data to identify and document different flow features in the surface ocean such as eddies and fronts.	
Required skills, knowledge or experience: Experience with programming languages such as MATLAB or Python is essential.	
Keywords: ocean drifters, surface currents, eddies, dispersion	
Supervisor Contact email: chari.pattiaratchi@uwa.edu.au	
Project supervised: Both online and Face to Face	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 2	**Total number of place(s) available with supervisor:** 4 **(** 2 for this project)

School: Oceans Graduate School	
Main Supervisor: Prof C Pattiaratchi	**Co-supervisor(s):** Dr Paul Thomson, Dr Mun Woo
Project title:	Ocean glider data analysis II
Lab/Group: Coastal Oceanography **Lab/Group Link: https://www.web.uwa.edu.au/coastal-oceanography**	
Project description: **<u>Project 2</u>** Ocean gliders are autonomous underwater vehicles that propel themselves with changes in buoyancy, ascending and descending through the water column. The gliders are relatively cheap, reusable and can be remotely controlled, making them a relatively cost-effective method for collecting repeat subsurface ocean observations. They also allow for the acquisition of data under inclement weather conditions. Equipped with a variety of sensors, the gliders are designed to deliver ocean profile data. Furthermore, the unique design of the gliders enables them to move horizontally through the water while collecting vertical profiles. We are closely approaching the 300th mission and there are data extending over a decade for analysis of coastal ocean processes.	
Required skills, knowledge or experience: Experience with programming languages such as MATLAB or Python is essential.	
Keywords: ocean gliders, temperature, chlorophyll, underwater light	
Supervisor Contact email: chari.pattiaratchi@uwa.edu.au	
Project supervised: Both online and Face to Face	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 2	**Total number of place(s) available with supervisor:** 4 (2 for this project)

School: Oceans Graduate School	
Main Supervisor: Prof Ryan Lowe	**Co-supervisor(s):** Justin Geldard, Scott Draper, Marco Ghisalberti, Arnold van Rooijen
Project title:	**Assessing novel artificial reef structures for coastal flood protection**
Lab/Group: Coastal and Offshore Engineering Laboratory **Lab/Group Link:** https://www.uwa.edu.au/facilities/coel	
Project description: Traditionally, engineering strategies to manage flood risk along coastlines have relied on 'hard' on 'gray' engineering infrastructure, such as seawalls and breakwaters, that often have numerous undesirable consequences on a coastal zone (e.g. damaging coastal ecosystems, disrupting natural coastal processes, shifting problems to other adjacent coastal regions, and devaluing coastal amenities, including aesthetics). There is a growing movement internationally to adopt new "green" or "hybrid" approaches that use natural features of a coastal ecosystem to provide equivalent costal flood defence; this can for example, include planting or restoration of aquatic vegetation (e.g. seagrasses and salt marsh) and use of natural or artificial reefs. Successful nature-based flood defence projects can thus protect coastlines while having numerous additional co-benefits: such as enhancing coastal ecosystems, improving coastal water quality, providing habitat for marine species, and improving coastal aesthetics. For the project, the student will contribute to the development and testing of new artificial reef designs in UWA large-scale (54 m) long wave flume, in order to identify the capacity of different designs to dissipate wave energy and protect against coastal flooding.	
Required skills, knowledge or experience: - Basic programming skills (e.g., MATLAB, Python) - Background in wave dynamics / coastal engineering (preferred) - Experience with experimental data analysis	
Keywords: Coastal engineering, nature-based solutions, waves, coastal hazards	
Supervisor Contact email: Ryan.Lowe@uwa.edu.au	
Project supervised: Face to Face only	**Length of project:** Standard 8 weeks
Total number of project(s) offered by supervisor: 1	**Total number of place(s) available with supervisor:** 4

THE UNIVERSITY OF WESTERN AUSTRALIA

Perth is one of Australia's most affordable capital cities

(Worldwide Cost of Living Survey 2018, Economist Intelligence Unit)

Internationally recognised

Ranked in the world's Top 100

and **1st** in Western Australia *(ARWU 2019)*

5 stars+ for research, teaching, internationalisation, specialist criteria, employability, facilities, innovation and inclusiveness

(QS Stars University Ratings 2018)

Schooling for children of Master's & PhD students*

*Some schools have limited places and other modest fees apply. For more information visit study.uwa.edu.au/international-students/moving-to-perth/dependant-schooling

Ranked in the world's TOP 50

- Agriculture and Forestry
- Anatomy and Physiology
- Civil and Structural Engineering
- Earth and Marine Sciences
- Performing Arts
- Psychology
- Mineral and Mining Engineering

(QS 2018)

Global Engagement Office (GEO)

The University of Western Australia
M464A, 35 Stirling Highway
Perth WA 6009
Tel: +61 8 6488 7587
jerline.chen@uwa.edu.au

GROUP OF EIGHT AUSTRALIA

CRICOS Provider Code: 00126G