



ASTR310

Frontiers of Astronomy and Astrophysics

S2 Day 2019

Dept of Physics and Astronomy

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Disclaimer

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General Information

Unit convenor and teaching staff

Convenor

Richard McDermid

richard.mcdermid@mq.edu.au

Contact via 0298504476

E6B

Open door policy, but make an appointment to save disappointment.

Credit points

3

Prerequisites

ASTR377

Corequisites

Co-badged status

Unit description

We are in the midst of a golden age of astronomy and astrophysics, with results streaming in from a host of telescopes, spacecraft and supercomputers. In this unit students have an opportunity to join this voyage of discovery by planning and conducting their own research project under the guidance of professional astronomers at CSIRO Astronomy and Space Science, the Australian Astronomical Observatory or Macquarie University. Students will develop familiarity with the required tools to tackle a real-world astrophysics problem and conduct their research project. Students report on their progress and findings through presentations and written reports. In alternate years, students have the opportunity to take part in a field trip to major telescopes in Western New South Wales.

Important Academic Dates

Information about important academic dates including deadlines for withdrawing from units are available at <https://www.mq.edu.au/study/calendar-of-dates>

Learning Outcomes

On successful completion of this unit, you will be able to:

Demonstrate insight into the professional activities and work practises of astronomical, astrophysics and astrophotonics researchers, including engagement in regular colloquia, and exposure to professional telescope facilities.

Work effectively and responsibly as part of a project team, including the use of online collaborative tools and resources.

Think critically and analytically around interpreting the outcomes of a project and identify future strategic directions.

Apply techniques of project planning and time management, demonstrating the capacity to meet deadlines agreed upon with the partner.

Demonstrate the ability to articulate the goals and results of the project using different forms of communication, including a comprehensive piece of scientific writing, and an oral presentation.

Develop career networking skills and capabilities that will aid you with either moving into the workforce or further study.

General Assessment Information

In order to pass the unit, you must obtain a total mark of at least 50%, as well as a mark of at least 50% in the Project report.

Assessment Tasks

Name	Weighting	Hurdle	Due
<u>Project Report</u>	25%	Yes	Weeks 7 and 13
<u>Project Documentation</u>	15%	No	Weeks 5 and 13
<u>Mentor Report</u>	10%	No	Week 13
<u>Reflective Journal</u>	15%	No	Weeks 2-11
<u>Oral Presentation</u>	10%	No	week 12
<u>Professional Engagement</u>	15%	No	Week 13
<u>CV and cover letter</u>	10%	No	week 12

Project Report

Due: **Weeks 7 and 13**

Weighting: **25%**

This is a hurdle assessment task (see [assessment policy](#) for more information on hurdle assessment tasks)

This assessment has two components: Project Report (25% of total grade), and Mentor Report (10% of total grade).

Project Report

The students are required to submit a 2500-5000 word Project Report based on their external placement at the partner organisation. This will generally follow the structure of a scientific report, including introduction to the project topic, description of the data, tools and methods used, presentation of results and analysis, discussion of the findings, and conclusions. Typically, students will work in pairs with the partner. In those cases each student is expected to contribute equally to the project report, and the report must include a statement describing the contributions of each student to the joint project.

Note that in some cases Project progress and timely conclusion can be influenced by circumstances that are outside of the Student's control. This will be taken into account when assessing the report.

An introductory section will be due to the University Supervisor in Week 7, with the final report due in Week 13. The Project Report is worth 25% of the total unit grade.

The Project Report is a **Hurdle Assessment**. *You must obtain a mark of at least 50% in the report to be eligible to pass the unit.* If your mark in the report is less than 50%, you may be given a chance to revise and resubmit your report. The mark awarded for the revised report towards your final unit mark will be capped at 50%.

On successful completion you will be able to:

- Demonstrate insight into the professional activities and work practises of astronomical, astrophysics and astrophotonics researchers, including engagement in regular colloquia, and exposure to professional telescope facilities.
- Work effectively and responsibly as part of a project team, including the use of online collaborative tools and resources.
- Think critically and analytically around interpreting the outcomes of a project and identify future strategic directions.
- Apply techniques of project planning and time management, demonstrating the capacity to meet deadlines agreed upon with the partner.
- Demonstrate the ability to articulate the goals and results of the project using different forms of communication, including a comprehensive piece of scientific writing, and an oral presentation.
- Develop career networking skills and capabilities that will aid you with either moving into the workforce or further study.

Project Documentation

Due: **Weeks 5 and 13**

Weighting: **15%**

Documentation is a key component to any project, and acts as an important record of your progress during the semester. It will also form an invaluable record when writing your final report, and will allow you to easily pick up where you left off the previous week when returning to your

project. The format of this documentation is flexible, and can be tuned to the specific nature of your PACE project. For example, some projects are well suited to keeping a lab book, either physical or electronic, which records all your daily tasks, recorded values, results, plots, thoughts, useful numbers, etc. For other projects, this documentation may come in a different form, e.g. organised notes or minutes from project meetings, GitHub commit records, or progress reports.

Whatever form you and your supervisor think is appropriate, your project documentation should:

- Include a **project plan** formed during the first few weeks of the project. This should include key milestones and dates.
- Be **legible** and clearly laid out, with **dates** against every entry/contribution.
- Include **regular** entries or updates. Most projects will make weekly progress, and so should have weekly updates to the documentation collection.

Your project mentor will review your project documentation during week 5 to provide feedback on your project plan, as well as feedback on your overall record keeping. You are required to submit your complete project documentation following the submission of your project report in week 13, either physically or via email to the unit convenor (for electronic records).

On successful completion you will be able to:

- Demonstrate insight into the professional activities and work practises of astronomical, astrophysics and astrophotonics researchers, including engagement in regular colloquia, and exposure to professional telescope facilities.
- Work effectively and responsibly as part of a project team, including the use of online collaborative tools and resources.
- Think critically and analytically around interpreting the outcomes of a project and identify future strategic directions.
- Apply techniques of project planning and time management, demonstrating the capacity to meet deadlines agreed upon with the partner.
- Develop career networking skills and capabilities that will aid you with either moving into the workforce or further study.

Mentor Report

Due: **Week 13**

Weighting: **10%**

Your Macquarie Project Mentor will provide a report on your performance during the project. This will be based partly on input from your external project supervisor, as well as exchanges with your Project Mentor during the course of the project. The report will grade performance on topics such as meeting the learning outcomes of the unit, the quality of your contribution to the project and partner organisation, and ability to work as part of the project team. Engagement with the

field work activity will also be included in this assessment.

The Mentor report is worth 10% of the total unit grade.

On successful completion you will be able to:

- Work effectively and responsibly as part of a project team, including the use of online collaborative tools and resources.
- Think critically and analytically around interpreting the outcomes of a project and identify future strategic directions.
- Apply techniques of project planning and time management, demonstrating the capacity to meet deadlines agreed upon with the partner.

Reflective Journal

Due: **Weeks 2-11**

Weighting: **15%**

Each student must maintain an individual reflective journal on iLearn consisting of three parts:

Part 1: Initial self-reflection addressing the skills and knowledge gained during your degree thus far. This is the first section of the journal, and should be completed before starting the project in Week 2.

Part 2: Eight weekly reflective diary, capturing your thoughts about the project as it progresses. You will also be given some key topics to address in this part of your journal as you go along. These entries should be written throughout the semester. Bulk submissions in the last weeks will be penalised.

Part 3: Reflection on the project overall. This should be written near the project's completion, and should address: i) What were the main learning outcomes for you arising from the project? ii) Given the experience you have had through the project, what do you now feel are the most valuable or attractive attributes of your future workplace? How have these changed from before? iii) If you could repeat the unit, what would you do differently and why? Due in week 11.

10 reflective journal entries are required in total (but you can do more if you like). Each reflection should be about 200 words for the weekly entries; the initial and final reflections should be around 500 words. Journal entries are only visible to the unit convenor.

Further details and advice are provided on iLearn and in Workshop 1, and students are encouraged to contact the Unit staff for advice if they are struggling with this task.

On successful completion you will be able to:

- Work effectively and responsibly as part of a project team, including the use of online collaborative tools and resources.
- Think critically and analytically around interpreting the outcomes of a project and identify future strategic directions.

- Apply techniques of project planning and time management, demonstrating the capacity to meet deadlines agreed upon with the partner.
- Develop career networking skills and capabilities that will aid you with either moving into the workforce or further study.

Oral Presentation

Due: **week 12**

Weighting: **10%**

Each student will give a 10 minute presentation (with 3 minutes for questions) on their work in the final week of semester. For students working in pairs, they may present a joint 20 minute talk, as long as each person presents approximately half of the work. The talk should cover both the research component of the project, and the experience of working at the partner organisation.

Presentation slides should be uploaded to iLearn.

On successful completion you will be able to:

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Professional Engagement

Due: **Week 13**

Weighting: **15%**

A key role of professional scientists is engaging both with other scientists (through attending seminars) and with the public (through outreach activities). In this context, students are required to accrue at least 15 'professional engagement credits' during the course of the unit. Examples of relevant activities are: 1) Attending a Physics and Astronomy Department colloquium or similar seminar (= 1 credit); 2) Participating in a public observing night at the campus observatory (= 2 credits); 3) Visiting a school to give a presentation related to astronomy (= 3 credits); 4) Writing an article, blog, or other form of public- or professional-facing media about

astronomy (= 1-3 credits, depending on article length, peer review, etc.); 5) Taking a leadership role in a student, professional, or community organisation that fosters participation in science (=1-3 credits, depending on role). Other activities can be considered for these credits at the discretion of the unit convenor. No more than 5 credits can be claimed for similar activities.

Note that attendance of at least 3 seminars and 2 observatory sessions is mandatory.

You must document your Professional Engagement. E.g. for seminar attendance, give the date, speaker name, title, and short summary (few lines) of the talk. For observatory sessions, provide the dates you participated, and a couple sentences to say what you did (e.g. Were there any particular group that night? What objects did you observe? What was your role?). You may include photos, or any other relevant evidence of your activity. Each activity must include a few sentences describing how the activity has contributed to your professional development and career prospects as a scientist. You may wish to use the word template provided on iLearn to document each activity. You will submit your evidence via iLearn by Week 13, e.g. as a single pdf document, web links to external files (e.g. movies, powerpoint slides), etc.

On successful completion you will be able to:

- Demonstrate insight into the professional activities and work practises of astronomical, astrophysics and astrophotonics researchers, including engagement in regular colloquia, and exposure to professional telescope facilities.
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- Develop career networking skills and capabilities that will aid you with either moving into the workforce or further study.

CV and cover letter

Due: **week 12**

Weighting: **10%**

You will be required to provide a cover letter and curriculum vitae (CV) in response to a genuine job advert that you have researched and selected. An open application to an organisation you have chosen is also permitted if a suitable job advert is not available. You will be expected to use the tools and techniques you have acquired during the unit to find a suitable opening or organisation, and provide job-specific application materials in the form of a CV and cover letter.

Files will be submitted electronically via iLearn.

On successful completion you will be able to:

- Demonstrate insight into the professional activities and work practises of astronomical, astrophysics and astrophotonics researchers, including engagement in regular colloquia, and exposure to professional telescope facilities.
- Develop career networking skills and capabilities that will aid you with either moving into the workforce or further study.

Delivery and Resources

Workshop Activities

There will be three main workshops associated with the unit, for which attendance is mandatory:

Workshop 1 (Week 1, Friday, 11am-3pm): Orientation

This introductory morning workshop will review the unit goals, give students the chance to introduce themselves and their project (If known), and review some basic content on best work practices, health and safety, ethics, professional development, and reflective practice. These are essential tools for making the most of your practical experience during the unit.

Workshop 2 (Week 1, Friday, 3pm-6pm): Themes, Knowledge and Skills

This afternoon workshop follows on from workshop 1, and will be aimed at reflecting on the skills and knowledge you have gained across your degree, and how this might map to potential employers, and what they are looking for. We will look at how to recognise our strengths and make best use of them; as well as identifying areas where we can improve, and make plans on how to develop those areas during the unit. Finally, we will make a first draft of a personal curriculum vitae (CV, resume).

Workshop 3 (Week 11, Friday, time will be announced on iLearn): Presentation and interview skills

This workshop will focus on two key opportunities where we present ourselves to our colleagues in a professional context: giving a formal presentation; and giving a job interview. The workshop will look at techniques for delivering an informative and professional presentation, and will go through the process involved in a typical professional job interview. We will use a combination of delivered content and group exercises, including mock interviews, with a focus on developing confidence and experience in presenting in different situations.

Project

The main component of this unit is a project conducted with an external partner organisation, such as the Australian Astronomical Observatory (AAO) or the CSIRO Astronomy and Space Science division (CASS). Projects range from pure research to projects with a more educational or outreach flavour. All projects, however, should give you exposure to a professional working environment, and the opportunity to contribute to a larger effort related to professional astronomy and science. You will spend nominally 10 days working with the partner organisation, spread over 10 weeks of the semester (but this can vary from project to project). Projects should start in Week 2, concluding in Week 11, but again there will be some variations in schedule according to

the particular project.

Supervisors

The project has a supervisor at the host organisation, who is able to devote some time to supervising the students on the days that they attend the host organisation. At the start of the project, agree on a time or day when you are most likely to have overlap with your supervisor. If you don't have regular access to your project supervisor, let the unit convenor know as soon as possible so that alternative arrangements can be made.

The Physics and Astronomy Department at Macquarie University also appoints a University staff supervisor/mentor to maintain liaison, monitor progress and assist in advising students. Students will meet with the Unit convenor / University Supervisor at least twice during the semester to review lab-books, work diaries and progress against project objectives. One of these meetings will take place at the host organisation.

Required Unit Materials

You will be working within the premises of the partner organisation. Compliance with standard Work Health and Safety (WHS, sometimes also called Occupational Health & Safety, or OH&S) practise is expected. This includes wearing appropriate clothing and footwear (e.g. covered shoes), and following all workplace rules as defined by the Partner. If you are unsure of these rules, ask your supervisors.

Required Text

Not applicable, but project supervisors may recommend relevant readings.

Record-keeping

Each student must maintain an individual lab book or work diary. The lab book needs to be completed for each day of work on the project. Entries in the lab book must be viewed and approved as correct records by the Partner supervisor on a regular basis (at least fortnightly). Students will be required to hand in their lab books to the Partner supervisor as part of the assessment process. The work diary is a record of the additional reading and reflective research undertaken by each student on areas relevant to working in an industry environment. Students will be required to hand in their diaries to the University supervisor as part of the assessment process.

Field Trip

During the mid-semester break, we will have a 4-day (3 nights) field trip to professional research telescopes in New South Wales, including the famous Parkes radio dish and Anglo-Australian Telescope. We will receive 'behind the scenes' tours of these large national facilities, meet with professional astronomers, and look at what it takes to build, maintain and operate research infrastructure on this large scale. We will also take advantage of being far from the city lights to do some astrophotography of our own, weather permitting.

We will hold a field trip information session in Week 6. Accommodation costs are covered by the Department, but you will be asked by the unit convenor to complete a PACE travel grant application before the trip.

Teaching Strategy

Students spend around 10 days within the host organisation, plus the 4-day field trip. This time should be used effectively in the pursuit of the objectives identified by the partner supervisor and unit learning outcomes. A clear understanding of the project objectives and appropriate planning will facilitate progress towards the project objectives. Students are expected to regularly graph and analyse their results (if appropriate), and keep comprehensive and up-to-date records in their lab-books. The Partner and University supervisor/mentor will review the research plan and lab-books to ensure good practise in this respect. Students are also expected to maintain a work diary that captures other project related reading and reflective analysis undertaken by the student.

Unit Schedule

PACE

PACE stands for Participation and Community Engagement. By connecting students with partner organisations, PACE gives Macquarie students the chance to contribute their academic learning, enthusiasm and fresh perspective to the professional workplace. ASTR310 has been a PACE unit since 2013. PACE activities in this unit includes astronomy outreach at our Macquarie University observatory and a activities at either the Australian Astronomical Observatory or CSIRO Astronomy and Space Science.

Attendance

The unit has three key elements: Skills workshops (3 workshops over 2 days), external project (10 days over semester), field trip (4 days in mid-term break). Attendance of all three components is mandatory.

Students are required to be on-site at the host organisation when undertaking the project. The total project duration is 10 days. Typically, students will devote one day a week (nominally Friday) during 2nd semester (Weeks 1 to 13) working on the project at the partner institution. On some of these days some time may be spent at the University or elsewhere pursuing the objectives of the project with the agreement of the partner supervisor.

In addition, there will be several 'workshop' activities during the semester on topics including ethics, communication, and career skills (see above).

Professional Engagement

A total of 15 'Professional Engagement' credits must be earned by participating in professional activities during the semester. This includes mandatory attendance of at least 3 seminars/ colloquia (worth 1 credit each) and acting as guide for 2 campus observatory public sessions (worth 2 credits each) over the course of the semester. Additional credits can be gained by participating in suitable professional development activities, such as external skill development workshops, building a professional online profile, public outreach, etc. The unit convenor has the final say on what counts for credit and at what level.

Field Trip

A 4-day field trip to the Anglo-Australia Telescope and the Australa Telescope National Facility

Compact Array will take place during the September mid-term break.

Progress Meetings

Students are required to attend progress meetings at the external site as arranged by the University supervisor. At least one such meeting will take place during the project.

Learning and Teaching Activities

Field Trip

A visit to the Anglo Australia Telescope, the Australia Telescope Compact Array and other smaller telescopes, where the research process from proposal to data acquisition will be experienced directly.

Research Project

A project in partnership with an active researcher at the partner organisation (AAO or CASS).

Observatory Service

Acting as a demonstrator at public observing nights at the Macquarie University observatory.

Seminar Participation

Listening to and reflecting on seminars by expert visiting astronomers both at Macquarie and the partner organisation.

Workshop Activities

Attending or completing online and in-class modules that cover issues of ethics, communication, and career skills during the semester.

Professional Engagement

Participating in forms of professional service or development

Policies and Procedures

Macquarie University policies and procedures are accessible from [Policy Central](https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central) (<https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central>). Students should be aware of the following policies in particular with regard to Learning and Teaching:

- [Academic Appeals Policy](#)
- [Academic Integrity Policy](#)
- [Academic Progression Policy](#)
- [Assessment Policy](#)
- [Fitness to Practice Procedure](#)
- [Grade Appeal Policy](#)

- [Complaint Management Procedure for Students and Members of the Public](#)
- [Special Consideration Policy](#) (**Note:** *The Special Consideration Policy is effective from 4 December 2017 and replaces the Disruption to Studies Policy.*)

Undergraduate students seeking more policy resources can visit the [Student Policy Gateway](https://students.mq.edu.au/support/study/student-policy-gateway) (<https://students.mq.edu.au/support/study/student-policy-gateway>). It is your one-stop-shop for the key policies you need to know about throughout your undergraduate student journey.

If you would like to see all the policies relevant to Learning and Teaching visit [Policy Central](http://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central) (<http://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central>).

Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: <https://students.mq.edu.au/study/getting-started/student-conduct>

Results

Results published on platform other than [eStudent](#), (eg. iLearn, Coursera etc.) or released directly by your Unit Convenor, are not confirmed as they are subject to final approval by the University. Once approved, final results will be sent to your student email address and will be made available in [eStudent](#). For more information visit ask.mq.edu.au or if you are a Global MBA student contact globalmba.support@mq.edu.au

Student Support

Macquarie University provides a range of support services for students. For details, visit <http://students.mq.edu.au/support/>

Learning Skills

Learning Skills (mq.edu.au/learningskills) provides academic writing resources and study strategies to improve your marks and take control of your study.

- [Workshops](#)
- [StudyWise](#)
- [Academic Integrity Module for Students](#)
- [Ask a Learning Adviser](#)

Student Services and Support

Students with a disability are encouraged to contact the [Disability Service](#) who can provide appropriate help with any issues that arise during their studies.

Student Enquiries

For all student enquiries, visit Student Connect at ask.mq.edu.au

If you are a Global MBA student contact globalmba.support@mq.edu.au

IT Help

For help with University computer systems and technology, visit http://www.mq.edu.au/about_us/offices_and_units/information_technology/help/.

When using the University's IT, you must adhere to the [Acceptable Use of IT Resources Policy](#). The policy applies to all who connect to the MQ network including students.

Graduate Capabilities

Creative and Innovative

Our graduates will also be capable of creative thinking and of creating knowledge. They will be imaginative and open to experience and capable of innovation at work and in the community. We want them to be engaged in applying their critical, creative thinking.

This graduate capability is supported by:

Learning outcomes

- Demonstrate insight into the professional activities and work practises of astronomical, astrophysics and astrophotonics researchers, including engagement in regular colloquia, and exposure to professional telescope facilities.
- Work effectively and responsibly as part of a project team, including the use of online collaborative tools and resources.
- Apply techniques of project planning and time management, demonstrating the capacity to meet deadlines agreed upon with the partner.
- Demonstrate the ability to articulate the goals and results of the project using different forms of communication, including a comprehensive piece of scientific writing, and an oral presentation.

Assessment tasks

- Project Report
- Project Documentation
- Mentor Report
- Reflective Journal
- Oral Presentation
- Professional Engagement
- CV and cover letter

Learning and teaching activities

- A visit to the Anglo Australia Telescope, the Australia Telescope Compact Array and other smaller telescopes, where the research process from proposal to data acquisition

will be experienced directly.

- A project in partnership with an active researcher at the partner organisation (AAO or CASS).
- Acting as a demonstrator at public observing nights at the Macquarie University observatory.
- Listening to and reflecting on seminars by expert visiting astronomers both at Macquarie and the partner organisation.
- Attending or completing online and in-class modules that cover issues of ethics, communication, and career skills during the semester.

Capable of Professional and Personal Judgement and Initiative

We want our graduates to have emotional intelligence and sound interpersonal skills and to demonstrate discernment and common sense in their professional and personal judgement. They will exercise initiative as needed. They will be capable of risk assessment, and be able to handle ambiguity and complexity, enabling them to be adaptable in diverse and changing environments.

This graduate capability is supported by:

Learning outcomes

- Demonstrate insight into the professional activities and work practises of astronomical, astrophysics and astrophotonics researchers, including engagement in regular colloquia, and exposure to professional telescope facilities.
- Work effectively and responsibly as part of a project team, including the use of online collaborative tools and resources.
- Think critically and analytically around interpreting the outcomes of a project and identify future strategic directions.
- Apply techniques of project planning and time management, demonstrating the capacity to meet deadlines agreed upon with the partner.
- Develop career networking skills and capabilities that will aid you with either moving into the workforce or further study.

Assessment tasks

- Project Report
- Project Documentation
- Mentor Report
- Reflective Journal
- Oral Presentation
- Professional Engagement

- CV and cover letter

Learning and teaching activities

- A visit to the Anglo Australia Telescope, the Australia Telescope Compact Array and other smaller telescopes, where the research process from proposal to data acquisition will be experienced directly.
- A project in partnership with an active researcher at the partner organisation (AAO or CASS).
- Listening to and reflecting on seminars by expert visiting astronomers both at Macquarie and the partner organisation.
- Attending or completing online and in-class modules that cover issues of ethics, communication, and career skills during the semester.
- Participating in forms of professional service or development

Commitment to Continuous Learning

Our graduates will have enquiring minds and a literate curiosity which will lead them to pursue knowledge for its own sake. They will continue to pursue learning in their careers and as they participate in the world. They will be capable of reflecting on their experiences and relationships with others and the environment, learning from them, and growing - personally, professionally and socially.

This graduate capability is supported by:

Learning outcome

- Work effectively and responsibly as part of a project team, including the use of online collaborative tools and resources.

Assessment tasks

- Project Report
- Project Documentation
- Mentor Report
- Reflective Journal
- Oral Presentation
- Professional Engagement

Learning and teaching activities

- A visit to the Anglo Australia Telescope, the Australia Telescope Compact Array and other smaller telescopes, where the research process from proposal to data acquisition will be experienced directly.
- A project in partnership with an active researcher at the partner organisation (AAO or

CASS).

- Acting as a demonstrator at public observing nights at the Macquarie University observatory.
- Listening to and reflecting on seminars by expert visiting astronomers both at Macquarie and the partner organisation.
- Attending or completing online and in-class modules that cover issues of ethics, communication, and career skills during the semester.
- Participating in forms of professional service or development

Discipline Specific Knowledge and Skills

Our graduates will take with them the intellectual development, depth and breadth of knowledge, scholarly understanding, and specific subject content in their chosen fields to make them competent and confident in their subject or profession. They will be able to demonstrate, where relevant, professional technical competence and meet professional standards. They will be able to articulate the structure of knowledge of their discipline, be able to adapt discipline-specific knowledge to novel situations, and be able to contribute from their discipline to inter-disciplinary solutions to problems.

This graduate capability is supported by:

Learning outcomes

- Demonstrate insight into the professional activities and work practises of astronomical, astrophysics and astrophotonics researchers, including engagement in regular colloquia, and exposure to professional telescope facilities.
- Work effectively and responsibly as part of a project team, including the use of online collaborative tools and resources.
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- Demonstrate the ability to articulate the goals and results of the project using different forms of communication, including a comprehensive piece of scientific writing, and an oral presentation.
- Develop career networking skills and capabilities that will aid you with either moving into the workforce or further study.

Assessment tasks

- Project Report
- Project Documentation

- Mentor Report
- Reflective Journal
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- A visit to the Anglo Australia Telescope, the Australia Telescope Compact Array and other smaller telescopes, where the research process from proposal to data acquisition will be experienced directly.
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- Attending or completing online and in-class modules that cover issues of ethics, communication, and career skills during the semester.
- Participating in forms of professional service or development

Critical, Analytical and Integrative Thinking

We want our graduates to be capable of reasoning, questioning and analysing, and to integrate and synthesise learning and knowledge from a range of sources and environments; to be able to critique constraints, assumptions and limitations; to be able to think independently and systemically in relation to scholarly activity, in the workplace, and in the world. We want them to have a level of scientific and information technology literacy.

This graduate capability is supported by:

Learning outcomes

- Work effectively and responsibly as part of a project team, including the use of online collaborative tools and resources.
- Think critically and analytically around interpreting the outcomes of a project and identify future strategic directions.
- Apply techniques of project planning and time management, demonstrating the capacity to meet deadlines agreed upon with the partner.
- Demonstrate the ability to articulate the goals and results of the project using different forms of communication, including a comprehensive piece of scientific writing, and an oral presentation.
- Develop career networking skills and capabilities that will aid you with either moving into the workforce or further study.

Assessment tasks

- Project Report
- Project Documentation
- Mentor Report
- Reflective Journal
- Oral Presentation
- Professional Engagement
- CV and cover letter

Learning and teaching activities

- A visit to the Anglo Australia Telescope, the Australia Telescope Compact Array and other smaller telescopes, where the research process from proposal to data acquisition will be experienced directly.
- A project in partnership with an active researcher at the partner organisation (AAO or CASS).
- Attending or completing online and in-class modules that cover issues of ethics, communication, and career skills during the semester.
- Participating in forms of professional service or development

Problem Solving and Research Capability

Our graduates should be capable of researching; of analysing, and interpreting and assessing data and information in various forms; of drawing connections across fields of knowledge; and they should be able to relate their knowledge to complex situations at work or in the world, in order to diagnose and solve problems. We want them to have the confidence to take the initiative in doing so, within an awareness of their own limitations.

This graduate capability is supported by:

Learning outcomes

- Demonstrate insight into the professional activities and work practises of astronomical, astrophysics and astrophotonics researchers, including engagement in regular colloquia, and exposure to professional telescope facilities.
- Work effectively and responsibly as part of a project team, including the use of online collaborative tools and resources.
- Think critically and analytically around interpreting the outcomes of a project and identify future strategic directions.
- Demonstrate the ability to articulate the goals and results of the project using different forms of communication, including a comprehensive piece of scientific writing, and an

oral presentation.

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Effective Communication

We want to develop in our students the ability to communicate and convey their views in forms effective with different audiences. We want our graduates to take with them the capability to read, listen, question, gather and evaluate information resources in a variety of formats, assess, write clearly, speak effectively, and to use visual communication and communication technologies as appropriate.

This graduate capability is supported by:

Learning outcomes

- Demonstrate insight into the professional activities and work practises of astronomical, astrophysics and astrophotonics researchers, including engagement in regular colloquia, and exposure to professional telescope facilities.
- Work effectively and responsibly as part of a project team, including the use of online collaborative tools and resources.
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- A project in partnership with an active researcher at the partner organisation (AAO or CASS).
- Acting as a demonstrator at public observing nights at the Macquarie University observatory.
- Listening to and reflecting on seminars by expert visiting astronomers both at Macquarie and the partner organisation.
- Attending or completing online and in-class modules that cover issues of ethics, communication, and career skills during the semester.
- Participating in forms of professional service or development

Engaged and Ethical Local and Global citizens

As local citizens our graduates will be aware of indigenous perspectives and of the nation's historical context. They will be engaged with the challenges of contemporary society and with knowledge and ideas. We want our graduates to have respect for diversity, to be open-minded, sensitive to others and inclusive, and to be open to other cultures and perspectives: they should have a level of cultural literacy. Our graduates should be aware of disadvantage and social justice, and be willing to participate to help create a wiser and better society.

This graduate capability is supported by:

Learning outcomes

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- Participating in forms of professional service or development

Socially and Environmentally Active and Responsible

We want our graduates to be aware of and have respect for self and others; to be able to work with others as a leader and a team player; to have a sense of connectedness with others and country; and to have a sense of mutual obligation. Our graduates should be informed and active participants in moving society towards sustainability.

This graduate capability is supported by:

Learning outcomes

- Demonstrate insight into the professional activities and work practises of astronomical, astrophysics and astrophotonics researchers, including engagement in regular colloquia, and exposure to professional telescope facilities.
- Develop career networking skills and capabilities that will aid you with either moving into the workforce or further study.

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- Participating in forms of professional service or development