ASTR278

Advanced Astronomy

S2 Day 2017

Dept of Physics and Astronomy

Contents

General Information

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Credit points 3
Prerequisites PHYS201
Corequisites
Co-badged status
Unit description This unit is designed to give students an appropriate background and theoretical understanding of astronomical observations and selected topics in galaxy and stellar evolution. Fundamental limits to sensitivity, angular and spectroscopic resolution are explored, as well as the technology to reach these limits, including active and adaptive optics. Key concepts of multi-wavelength imaging and spectroscopy are discussed, including the role of optical fibres. The unit also specifically covers the effects of the earth's atmosphere; detection theory and detectors; and associated image processing techniques. Aspects of galaxy structure, galaxy formation and stellar evolution will be covered that draw upon mathematical methods learnt in first year. This unit involves practical experiments based on some of these concepts and may involve evening work at the University's optical and radio observatory.

Important Academic Dates

Information about important academic dates including deadlines for withdrawing from units are available at https://students.mq.edu.au/important-dates

Learning Outcomes

1. Demonstrate an understanding of astronomical units and coordinate systems in solar-system, stellar and extragalactic astronomy through an ability to make credible observing plans.

2. Familiarity with python programming and its application to preparing astronomical imaging for analysis. Experience with industry-standard software tools: juypter notebook, github and ds9.
3. Understand advanced conceptual topics in galactic, stellar and multiwavelength astronomy.
4. Describe the concepts behind and solve problems about the effects of the Earths atmosphere on astronomical imaging.
5. Describe concepts behind and solve problems about technologies used in optical and infrared astronomy including adaptive optics and fibre-optics.
6. Describe concepts behind and solve problems about observing techniques and technologies in optical, radio and other wavelength regimes.

General Assessment Information

Hurdle tasks

This unit has hurdle requirements, specifying a minimum standard that must be attained in aspects of the unit. To pass this unit you must obtain marks of at least 40% in the final examination and an overall 50% in the unit.

Second-chance hurdle examinations will be offered in the week of December 11 - 15. You will be notified shortly after the marks are released of your eligibility for a hurdle retry and you must also make yourself available during that week to take advantage of this opportunity.

Late Assessments Policy

The non-examination assessment components should be submitted via iLearn or github by the due date and time.

The penalty for late submission is deduction of 5% of the possible mark for that item for each 24 hour period (or part) overdue. Assessments will not be accepted for marking if submitted more than 1 week past the due date. Extensions to the due dates for assignments, practical assessments, and project will only be considered if requested with valid reason prior to the due date.

Students anticipating or experiencing difficulties in meeting a deadline should discuss this with one of the lecturers in the first instance, ideally ahead of the deadline, if at all possible. Students should also be familiar with the University's Disruptions to Study policy (http://www.mq.edu.au/policy/docs/disruption_studies/policy.html).

Assessment Tasks

Name	Weighting	Hurdle	Due
Labs	50%	No	1 week after final lab

Name	Weighting	Hurdle	Due
Final examination	50%	Yes	University Examination Period
Non-compulsory assignments	0%	No	N/A

Labs

Due: **1 week after final lab**
Weighting: **50%**

Labs will run during weeks 1 to 12 on Wednesdays 1-4pm in the 2nd year physics lab. The first lab will take the form of exercises using the python computing language to manipulate astronomical imaging data over weeks 1-3. The second lab will apply the python techniques to astronomical data collected by the class at the Macquarie Observatory. The final 3 labs will each take place over 2 weeks and will focus on various hands-on astronomical instrumentation activities.

Lab reports or python notebooks must be submitted electronically to iLearn or github, respectively. Each report is due 1 week after completion of the lab. The marks will be based on completion of the laboratory exercises where possible, a demonstrated understanding of the material in your report and adherence to good experimental practice.

There will be 5 equally-weighted assessment tasks: 2 in the first half of the unit, and 3 in the second half. The first two labs will be assigned three weeks of lab time. The final three labs will be assigned two weeks of lab time each.

This Assessment Task relates to the following Learning Outcomes:

- Demonstrate an understanding of astronomical units and coordinate systems in solar-system, stellar and extragalactic astronomy through an ability to make credible observing plans.
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- Describe the concepts behind and solve problems about the effects of the Earths atmosphere on astronomical imaging.
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Final examination

Due: **University Examination Period**
Weighting: **50%**
This is a hurdle assessment task (see assessment policy for more information on hurdle assessment tasks)

The basic format will follow that of previous years. Calculators which do not have a full alphabet on the keyboard will be allowed into the examination.

You are expected to present yourself for the final examination at the time and place designated in the University examination timetable (http://www.timetables.mq.edu.au/exam/). The timetable will be available in draft form approximately eight weeks before the commencement of examinations and in final form approximately four weeks before the commencement of examinations.

The final examination is a hurdle requirement. You must obtain a mark of at least 40% to be eligible to pass the unit. If your mark in the final examination is between 30% and 39% inclusive then you will be a given a second and final chance to attain the required level of performance.

If you apply for Disruption to Study for your final examination, you must make yourself available for the week of December 11 – 15, 2017. If you are not available at that time, there is no guarantee an additional examination time will be offered. Specific examination dates and times will be determined at a later date. **Second-chance hurdle examinations will also be offered in this week.**

This Assessment Task relates to the following Learning Outcomes:

- Understand advanced conceptual topics in galactic, stellar and multiwavelength astronomy.
- Describe the concepts behind and solve problems about the effects of the Earths atmosphere on astronomical imaging.
- Describe concepts behind and solve problems about technologies used in optical and infrared astronomy including adaptive optics and fibre-optics.
- Describe concepts behind and solve problems about observing techniques and technologies in optical, radio and other wavelength regimes.

Non-compulsory assignments

Due: **N/A**
Weighting: **0%**

Some of the questions in the final examination paper will be similar to those set for assignments. These will not be marked, but will be reviewed during tutorials and/or lectures. These will be released throughout the semester.

This Assessment Task relates to the following Learning Outcomes:

- Understand advanced conceptual topics in galactic, stellar and multiwavelength astronomy.
- Describe the concepts behind and solve problems about the effects of the Earths atmosphere on astronomical imaging.
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Delivery and Resources

Classes

Students are expected to attend all lectures. Lecture attendance provides students with the opportunity to ask questions about content that will be covered on the final exam.

Required and Recommended Texts and/or Materials

Required Text

There is no single textbook that covers all of the course material in this unit. Appropriate material will be provided during the course. Useful textbooks are listed below.

Recommended Reading/Useful References

Foundations of Astrophysics by Barbara Ryden, Addison-Wesley, (2009)

Observational Astrophysics by Robert C. Smith, Cambridge University Press (1995)

Astrophysical Techniques, C R Kitchin, Institute of Physics Publishing (2003)

Adaptive Optics for Astronomical Telescopes, John W Hardy, Oxford University Press (1998)

Astrophysical quantities, C W Allen, London : Athlone Press (1973) ISBN0485111500e

Teaching and Learning Strategy

This unit is taught through lectures and through undertaking laboratory experiments. Questions during and outside lectures are strongly encouraged in this unit - please do not be afraid to ask as it is likely that your classmates will also want to know the answer.

Unit Schedule

Week	Lecture topics summary
1	Intro to unit and obseving

2	Intro to galaxies: the Milky Way and galactic motions
3	Galactic context: environments and supermassive black holes
4	Observing galaxies: high and low redshifts
5	Multiwavelength observations
6	Basics of stellar astronomy
7	Intro instrumentation
8	Optics
9	Image formation
10	Adaptive optics
11	Fiber optics
12	Spectrographs

Laboratories (practicals) are compulsory and will commence in the first week of semester. Weather pending, some optional laboratory exercises will be at the Macquarie Observatory from sunset during Tuesday-Thursday on Week 2 (or Week 3 if weather is bad). Data collected at the observatory will be used in the laboratory sessions.

Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central. Students should be aware of the following policies in particular with regard to Learning and Teaching:

Academic Honesty Policy http://mq.edu.au/policy/docs/academic_honesty/policy.html

Assessment Policy http://mq.edu.au/policy/docs/assessment/policy_2016.html

Grade Appeal Policy http://mq.edu.au/policy/docs/gradeappeal/policy.html

Complaint Management Procedure for Students and Members of the Public http://www.mq.edu.au/policy/docs/complaint_management/procedure.html

Disruption to Studies Policy (in effect until Dec 4th, 2017): http://www.mq.edu.au/policy/docs/disruption_studies/policy.html

Special Consideration Policy (in effect from Dec 4th, 2017): https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policies/special-consideration

In addition, a number of other policies can be found in the Learning and Teaching Category of 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/support/student_conduct/

Results

Results shown in *iLearn*, 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.

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 Enquiry Service

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

Equity 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.

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

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

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Assessment tasks

- Labs
- Final examination
- Non-compulsory assignments

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:

Assessment task

- Labs

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 an understanding of astronomical units and coordinate systems in solar-system, stellar and extragalactic astronomy through an ability to make credible observing plans.
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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

- Demonstrate an understanding of astronomical units and coordinate systems in solar-system, stellar and extragalactic astronomy through an ability to make credible observing plans.

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