ASTR3010

Astrophysics of Radiation and Stars

Session 1, In person-scheduled-weekday, North Ryde 2024

School of Mathematical and Physical Sciences

Contents

General Information

Unit convenor and teaching staff
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Credit points
10

Prerequisites (ASTR278 or ASTR2020) and (PHYS202 or PHYS2020) and (MATH236 or MATH232 or MATH2020 or MATH2110)
Corequisites
Co-badged status
Unit description The first part of this unit covers the physical mechanisms responsible for the generation, absorption and scattering of light in environments as diverse as rarefied nebulae, hot compact stellar atmospheres and distant galaxies. During the second part of the unit the theory of stellar structure and evolution is developed. Students become familiar with spectroscopic observations and the python programming language, and carry out a project using computer models of how stars live and die.

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:

ULO1: discuss principles and difficulties of observational methods that allow us to interpret the physical characteristics of an astronomical object based on the light we receive from it.

ULO2: demonstrate knowledge of the way radiation interacts with matter in different astrophysical environments through solving radiative transfer problems.

ULO3: describe the internal structure of our Sun and stars other than the Sun, and explain the key observational properties of different types of stars.

ULO4: apply the equations of stellar structure and the simplifications that lead to polytropic stellar models.

ULO5: explain the processes and physics involved in stellar evolution, including the processes that bring about stellar death.

ULO6: apply computational techniques to model physical phenomena in different astrophysical environments using the Unix environment and elements of the python computing language.

ULO7: design, conduct, analyse and report on observational experiments related to measuring the radiation from stars, galaxies and other astronomical objects in order to

determine their properties.

General Assessment Information

Project: a computational project based on calculating and analysing the structure and evolution of a given star. The Project report will be due one week after the last PC Lab class.

Assignments: there will be 4 assignments, 2 for each part of the unit. They will be approximately evenly distributed across the unit.

Observational task: Students will observe a number of targets using MQ Observatory. They will also analyse their observational data (in case of bad weather, data will be provided). A small component of this observational task will be conducted in the laboratory. The students will have to carry out some tasks related to constructing an astronomical spectrograph. A report of this activity will be due after the semester break.

A standard, 3-hour, written exam (plus 10 min reading time) will be given in the university examination period.

The unit's assessment includes two hurdle assessment tasks (a project and the final examination); see the descriptions of all assessment tasks below for detailed information, including for policies in place in case a student fails these assessment tasks. To achieve a pass grade, students must achieve a total mark equal to or greater than 50%, **and obtain a mark of at least 40% for both the final exam and the project**. If your mark in the final examination is between 30% and 39% inclusive, you may be a given a second and final chance to attain the required level of performance; the mark awarded for the second exam towards your final unit mark will be capped at 40%, and you will be allowed to sit the second exam only if this mark would be sufficient to pass the unit overall.

Late Assessment Submission Penalty

From 1 July 2022, Students enrolled in Session based units with written assessments will have the following late penalty applied. Please see https://students.mq.edu.au/study/assessment-exams/assessments for more information.

Unless a Special Consideration request has been submitted and approved, a 5% penalty (of the total possible mark) will be applied each day a written assessment is not submitted, up until the 7th day (including weekends). After the 7th day, a grade of '0' will be awarded even if the assessment is submitted. Submission time for all written assessments is set at 11:55 pm. A 1-hour grace period is provided to students who experience a technical concern.

For any late submission of time-sensitive tasks, such as scheduled tests/exams, performance assessments/presentations, and/or scheduled practical assessments/labs, students need to submit an application for Special Consideration.

In this unit, late submissions will accepted as follows:

- Assignments – YES, Standard Late Penalty applies
- Observational Analysis Task – YES, Standard Late Penalty applies

- Project – YES, Standard Late Penalty applies

Project

Assessment Type [1]: Project Indicative Time on Task [2]: 10 hours Due: **Monday Week 11.** Weighting: **20%** Given that computational analysis of stellar structure equations is an essential aspect of this unit, **this is a hurdle assessment task, requiring students to achieve a mark of at least 40% (see assessment policy for more information on hurdle assessment tasks).**

Project involving computer programming, astrophysical interpretation, report and presentation

On successful completion you will be able to:

- apply computational techniques to model physical phenomena in different astrophysical environments using the Unix environment and elements of the python computing language.

Failure of this hurdle assessment will require the student to retake the unit when it is next offered. Alternatively, opportunities may be offered to amend aspects of this task in order to pass the hurdle.

Observational Analysis Task

Assessment Type [1]: Lab report Indicative Time on Task [2]: 0 hours Due: **Monday Week 8** Weighting: **20%**

A report on the outcomes of collection and analysis of observational data.

On successful completion you will be able to:

- apply computational techniques to model physical phenomena in different astrophysical environments using the Unix environment and elements of the python computing language.
- design, conduct, analyse and report on observational experiments related to measuring the radiation from stars, galaxies and other astronomical objects in order to determine their properties.

Assignments

Assessment Type [1]: Problem set Indicative Time on Task [2]: 18 hours Due: **A#1 Mon W6; A#2 Mon W8; A#3 Mon W10; A#4 Mon W13.** Weighting: **20%**

A series of assignments throughout the session

On successful completion you will be able to:

- discuss principles and difficulties of observational methods that allow us to interpret the

physical characteristics of an astronomical object based on the light we receive from it.
- demonstrate knowledge of the way radiation interacts with matter in different astrophysical environments through solving radiative transfer problems.
- describe the internal structure of our Sun and stars other than the Sun, and explain the key observational properties of different types of stars.
- apply the equations of stellar structure and the simplifications that lead to polytropic stellar models.
- explain the processes and physics involved in stellar evolution, including the processes that bring about stellar death.

Final examination

Assessment Type [1]: Examination Indicative Time on Task [2]: 20 hours Due: **As per MQ Examination timetable.** Weighting: **40%** Given that the examination will assess a student's understanding of the entire subject matter covered in this unit (that is, covering learning objectives 1 through 5), **this is a hurdle assessment task (see assessment policy for more information on hurdle assessment tasks).**

Examination during the exam period covering all content from the unit.

On successful completion you will be able to:

- discuss principles and difficulties of observational methods that allow us to interpret the physical characteristics of an astronomical object based on the light we receive from it.
- demonstrate knowledge of the way radiation interacts with matter in different astrophysical environments through solving radiative transfer problems.
- describe the internal structure of our Sun and stars other than the Sun, and explain the key observational properties of different types of stars.
- apply the equations of stellar structure and the simplifications that lead to polytropic stellar models.
- explain the processes and physics involved in stellar evolution, including the processes that bring about stellar death.

Students who fail the final examination or have valid reasons for non-attendance will be offered the option to take a supplementary examination during the supplementary examination period.

[1] If you need help with your assignment, please contact:

- the academic teaching staff in your unit for guidance in understanding or completing this type of assessment
- the Writing Centre for academic skills support.

[2] Indicative time-on-task is an estimate of the time required for completion of the assessment task and is subject to individual variation

Assessment Tasks

Name	Weighting	Hurdle	Due
Assignments	20%	No	A#1 Mon W6; A#2 Mon W8; A#3 Mon W10; A#4 Mon W13.
Observational Analysis Task	20%	No	Monday Week 8
Project	20%	Yes	Monday Week 11
Final examination	40%	Yes	MQ Examination timetable

Assignments

Assessment Type [1]: Problem set
Indicative Time on Task [2]: 18 hours
Due: **A#1 Mon W6; A#2 Mon W8; A#3 Mon W10; A#4 Mon W13.**
Weighting: **20%**

A series of assignments throughout the session

On successful completion you will be able to:

- discuss principles and difficulties of observational methods that allow us to interpret the physical characteristics of an astronomical object based on the light we receive from it.
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Observational Analysis Task

Assessment Type [1]: Lab report
Indicative Time on Task [2]: 0 hours
Due: **Monday Week 8**

Weighting: **20%**

A report on the outcomes of collection and analysis of observational data.

On successful completion you will be able to:

- apply computational techniques to model physical phenomena in different astrophysical environments using the Unix environment and elements of the python computing language.
- design, conduct, analyse and report on observational experiments related to measuring the radiation from stars, galaxies and other astronomical objects in order to determine their properties.

Project

Assessment Type [1]: Project
Indicative Time on Task [2]: 10 hours
Due: **Monday Week 11**
Weighting: **20%**
This is a hurdle assessment task (see assessment policy for more information on hurdle assessment tasks)

Project involving computer programming, astrophysical interpretation, report and presentation

On successful completion you will be able to:

- apply computational techniques to model physical phenomena in different astrophysical environments using the Unix environment and elements of the python computing language.

Final examination

Assessment Type [1]: Examination
Indicative Time on Task [2]: 20 hours
Due: **MQ Examination timetable**
Weighting: **40%**
This is a hurdle assessment task (see assessment policy for more information on hurdle assessment tasks)

Examination during the exam period covering all content from the unit.

On successful completion you will be able to:

- discuss principles and difficulties of observational methods that allow us to interpret the physical characteristics of an astronomical object based on the light we receive from it.
- demonstrate knowledge of the way radiation interacts with matter in different astrophysical environments through solving radiative transfer problems.
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Delivery and Resources

Two hours per week lectures will be live/in-person and recorded on Echo360.

One hour per week SGTA will be class-based problems done in groups and alone.

Weeks 1–6: a series of observing sessions, computer lab sessions and laboratory sessions.

Weeks 7–13: 3 hours per week computer lab. Some in-between lab preparation needed.

Individual teaching staff will advise the student cohort how they can best be reached and how they plan to communicate with the student cohort in relation to their own teaching component(s). Staff emails are available on the unit's iLearn page (which contains a section titled "Unit information and communication") and iLearn discussion forum are one of the options students and staff have for their communication needs.

Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central (https://policies.mq.edu.au). 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
- Assessment Procedure
- Complaints Resolution Procedure for Students and Members of the Public
- Special Consideration Policy

Students seeking more policy resources can visit Student Policies (https://students.mq.edu.au/support/study/policies). It is your one-stop-shop for the key policies you need to know about throughout your undergraduate student journey.

To find other policies relating to Teaching and Learning, visit Policy Central (https://policies.mq.edu.au) and use the search tool.

Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: https://students.mq.edu.au/admin/other-resources/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

Academic Integrity

At Macquarie, we believe academic integrity – honesty, respect, trust, responsibility, fairness and courage – is at the core of learning, teaching and research. We recognise that meeting the expectations required to complete your assessments can be challenging. So, we offer you a range of resources and services to help you reach your potential, including free online writing and maths support, academic skills development and wellbeing consultations.

Student Support

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

The Writing Centre

The Writing Centre provides resources to develop your English language proficiency, academic writing, and communication skills.

- Workshops
- Chat with a WriteWISE peer writing leader
- Access StudyWISE
- Upload an assignment to Studiosity
- Complete the Academic Integrity Module

The Library provides online and face to face support to help you find and use relevant information resources.

- Subject and Research Guides
- Ask a Librarian

Student Services and Support

Macquarie University offers a range of Student Support Services including:

- IT Support
- Accessibility and disability support with study
- Mental health support
- Safety support to respond to bullying, harassment, sexual harassment and sexual assault
- Social support including information about finances, tenancy and legal issues
- Student Advocacy provides independent advice on MQ policies, procedures, and processes

Student Enquiries

Got a question? Ask us via AskMQ, or contact Service Connect.

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.

Changes from Previous Offering

Unit content: No changes

For current teaching staff, consult the unit's iLearn page.

Unit information based on version 2024.02 of the Handbook