



ASTR7907

Advanced Astrophysics

Session 2, In person-scheduled-weekday, North Ryde 2026

School of Mathematical and Physical Sciences

Contents

<u>General Information</u>	2
<u>Learning Outcomes</u>	2
<u>General Assessment Information</u>	3
<u>Assessment Tasks</u>	4
<u>Delivery and Resources</u>	7
<u>Unit Schedule</u>	7
<u>Policies and Procedures</u>	7
<u>Changes from Previous Offering</u>	9

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General Information

Unit convenor and teaching staff

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Credit points

10

Prerequisites

Admission to GradDipResFSE or GradCertResFSE

Corequisites

Co-badged status

Unit description

This unit covers advanced topics in Astrophysics. For example the physics of fluid dynamics applied to accretion disks and jets in astrophysical objects such as black hole binaries; the physics of star and planet formation; the genesis of the elements; or galactic formation and evolution from the standpoints of interstellar gas and stellar populations. Observations of real celestial objects are used throughout the unit as examples of the processes we need to explain. Strong emphasis is placed on the connection between observations, interpretation and modelling. The scientific method will be used and emphasised as the backbone of all research. Computational techniques in modelling and/or in data analysis will also be used.

Learning in this unit enhances student understanding of global challenges identified by the United Nations Sustainable Development Goals ([UNSDGs](#)) Quality Education; Industry, Innovation and Infrastructure

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 stellar pulsations and role this plays in stellar evolution and mass loss.

ULO2: explain the synthesis of elements in stars and their observed chemical abundances.

ULO3: demonstrate an understanding of the dynamics of gas flows in Astrophysical environments, including magnetic fields, shocks and viscosity.

ULO4: solve problems in real-time during SGTA and workshops, and demonstrate solutions to peers

ULO5: communicate complex physical concepts in writing and orally.

ULO6: use numerical codes to solve astrophysical problems.

General Assessment Information

In order to pass the unit, you need to obtain a total mark of at least 50%.

Late Assessment Submission Penalty: Unless a Special Consideration request has been submitted and approved, a 5% penalty (of the total possible mark of the task) will be applied for each day a written report or presentation 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. The submission time for all uploaded assessments is **11:55 pm**. A 1-hour grace period will be 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, please apply for [Special Consideration](#).

Assessments where Late Submissions will be accepted

Project based assignment – YES, Standard Late Penalty applies

Special Consideration

The [Special Consideration Policy](#) aims to support students who have been impacted by short-term circumstances or events that are serious, unavoidable and significantly disruptive, and which may affect their performance in assessment. If you experience circumstances or events that affect your ability to complete the assessments in this unit on time, please inform the convenor and submit a Special Consideration request through <https://connect.mq.edu.au/>

A SUMMARY ON THE INDIVIDUAL ASSESSMENTS FOR THIS UNIT:

Project-based Assignment 1 (30%): An assignment focusing on the first half of the unit. It is a project-based assignment involving problem-solving, real-time data analysis, and coding. It assesses the application of numerical methods, interpretation of data, and understanding of astrophysical concepts through practical questions and coding tasks. This project focuses on essential skills not just in astrophysics but in virtually any profession that requires a science degree as a platform.

Project-based Assignment 2 (30%): An assignment focusing on the second half of the unit. It is a project based assignment designed to assess the understanding of astrophysical concepts

through practical and conceptual questions. Some of the material will be new to the students, and some will be from content already presented. While students are not expected to grasp every detail immediately, the assignment is structured to challenge their critical thinking and deepen their conceptual understanding of the underlying physics.

Final Examination (40%): The final examination questions will be in style of short and lengthy quizzes, but answered under controlled conditions and without the help of books. Battery or solar-powered calculators which do not have a full alphabet on the keyboard will be allowed into the examination. Calculators with text retrieval are not permitted for the final examination.

You are expected to present yourself for the final examination at the time and place designated in the University examination timetable. The timetable will generally 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 only exception to not sitting the examination at the designated time is because of documented illness or unavoidable disruption. In these circumstances, you may wish to apply for **Special Consideration** (see 'Special Consideration' in this Guide). You are advised that it is the policy of the University not to set early examinations for individuals or groups of students. All students are expected to ensure that they are available until the end of the teaching semester, i.e. the final day of the examination period.

If you receive special consideration for the final exam, a supplementary exam will be scheduled after results are released. By making a special consideration application for the final exam you are declaring yourself available for a resit during the supplementary examination period and will not be eligible for a second special consideration approval based on pre-existing commitments. Please ensure you are familiar with the policy prior to submitting an application. Approved applicants will receive an individual notification one week prior to the exam with the exact date and time of their supplementary examination.

¹ If you need help with your projects, 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	Groupwork/Individual	Short Extension	AI Approach
Project-based assignment	30%	No	13/09/2026	Individual	Yes	Open
Project-based assignment	30%	No	01/11/2026	Individual	Yes	Open

Name	Weighting	Hurdle	Due	Groupwork/Individual	Short Extension	AI Approach
<u>Final Exam</u>	40%	No	Exam Period	Individual	No	Observed

Project-based assignment

Assessment Type ¹: Experiential task

Indicative Time on Task ²: 24 hours

Due: **13/09/2026**

Weighting: **30%**

Groupwork/Individual: Individual

Short extension ³: Yes

AI Approach: Open

Project 1 – This assignment - covering the first half of the Unit - involves problem-solving, real-time data analysis, and coding. It assesses the application of numerical methods, interpretation of data, and understanding of astrophysical concepts through practical questions and coding tasks.

On successful completion you will be able to:

- discuss stellar pulsations and role this plays in stellar evolution and mass loss.
- explain the synthesis of elements in stars and their observed chemical abundances.
- demonstrate an understanding of the dynamics of gas flows in Astrophysical environments, including magnetic fields, shocks and viscosity.
- solve problems in real-time during SGTA and workshops, and demonstrate solutions to peers
- communicate complex physical concepts in writing and orally.
- use numerical codes to solve astrophysical problems.

Project-based assignment

Assessment Type ¹: Experiential task

Indicative Time on Task ²: 24 hours

Due: **01/11/2026**

Weighting: **30%**

Groupwork/Individual: Individual

Short extension ³: Yes

AI Approach: Open

Project 2 – This assignment - covering the second half of the Unit - involves problem-solving, real-time data analysis, and coding. It assesses the application of numerical methods, interpretation of data, and understanding of astrophysical concepts through practical questions and coding tasks.

On successful completion you will be able to:

- discuss stellar pulsations and role this plays in stellar evolution and mass loss.
- explain the synthesis of elements in stars and their observed chemical abundances.
- demonstrate an understanding of the dynamics of gas flows in Astrophysical environments, including magnetic fields, shocks and viscosity.
- solve problems in real-time during SGTA and workshops, and demonstrate solutions to peers
- communicate complex physical concepts in writing and orally.
- use numerical codes to solve astrophysical problems.

Final Exam

Assessment Type ¹: Examination

Indicative Time on Task ²: 25 hours

Due: **Exam Period**

Weighting: **40%**

Groupwork/Individual: Individual

Short extension ³: No

AI Approach: Observed

You will undertake a final examination during the formal examination period.

On successful completion you will be able to:

- discuss stellar pulsations and role this plays in stellar evolution and mass loss.
- explain the synthesis of elements in stars and their observed chemical abundances.
- demonstrate an understanding of the dynamics of gas flows in Astrophysical environments, including magnetic fields, shocks and viscosity.
- solve problems in real-time during SGTA and workshops, and demonstrate solutions to peers
- communicate complex physical concepts in writing and orally.

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
- [Academic Success](#) 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.

³ An automatic short extension is available for some assessments. Apply through the [Service](#)

[Connect Portal.](#)

Delivery and Resources

The course will be delivered through weekly lectures and tutorial sessions. The unit will be in two parts:

- 1) Stellar Evolution, Pulsations, and Nucleosynthesis (6.5 weeks, lecturer Dr Kateryna Andrych)
- 2) The physical interpretation of astronomical observations, the physics of the interstellar medium, and the astrophysics of accreting gas in star formation (6.5 weeks, Convenor Dr Tayyaba Zafar)

Each part will be assessed via a project-based assignment during the term, and will be approximately evenly represented in the final exam.

Methods of Communication

Communication will be via your **university email** or through **announcements on iLearn**. Queries to the convenor can either be placed on the iLearn discussion board or sent to tayyaba.zafar@mq.edu.au, kateryna.andrych@mq.edu.au, and maksym.mohorian@mq.edu.au from your university email address.

Unit Schedule

Weeks 1-6: Stellar Evolution, Pulsations, and Nucleosynthesis

Weeks 7-12: The physical interpretation of astronomical observations, the physics of the interstellar medium, and the astrophysics of accreting gas in star formation

Week 13: Revision

Policies and Procedures

Macquarie University policies and procedures are accessible from [Policy Central](https://policies.mq.edu.au) (<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) (<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) (<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 connect.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/>

Academic Success

[Academic Success](#) provides resources to develop your English language proficiency, academic writing, and communication skills.

- [Ask a Study Coach](#)
- [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 the [Service Connect Portal](#), or contact [Service Connect](#).

IT Help

For help with University computer systems and technology, visit <https://students.mq.edu.au/support/technology/service-desk>.

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

There are no major changes from last offering in S2 2025. We value student feedback as a means to continuously enhance our unit offerings. Students are encouraged to provide constructive feedback through surveys, direct communication with teaching staff, or via the FSE Student Experience & Feedback link on the iLearn page. Previous student feedback for this unit was positive, with students expressing satisfaction regarding assessment clarity and the support provided by teaching staff.

Unit information based on version 2026.02 of the [Handbook](#)