ASTR7907

Advanced Astrophysics

Session 2, In person-scheduled-weekday, North Ryde 2024

School of Mathematical and Physical Sciences

Contents

General Information

Unit convenor and teaching staff
Devika Kotachery
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Credit points
10

Prerequisites
Admission to MRes

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.

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

Weekly quizzes, Class Presentation - NO, unless Special Consideration is Granted

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 ask.mq.edu.au.

A SUMMARY ON THE INDIVIDUAL ASSESSMENTS FOR THIS UNIT:

Quizzes (15%): short quizzes will be scheduled to help students keep up with the material covered, and to help identify any problematic concepts.

Assignments (25%): two assignments relating to material covered in class will be given to test students' general understanding and problem-solving skills, as well as prepare students for the type of questions they can expect in the final exam. In each assignment, students may be asked to write short computer codes to solve parts of problems; programming a computer to answer questions that are not simple to answer in any other way is an essential skill not just in astrophysics but in virtually any profession that requires a science degree as a platform.

Class Presentations (30%): in 2 separate weeks students will be asked to read sets of notes, book pages or journal articles, or some combination of these media dealing with an astrophysical topic. Some of the material will be new to the students, and some will be from content already presented. It is not expected that students understand everything they read; however, it is

expected that they be able to present questions about any aspects that they do not fully comprehend, and that these questions be in the context of those concepts that they do understand. The ability to explain a concept in a clear fashion and according to a pre-agreed specification (level of detail, time constraints, etc.) is a key skill to be mastered by any science student, which is why this assessment task is part of the unit.

This assessment task also allows the lecturer to "flip" part of the unit. The oral sessions in which students are presenting and discussing material that has not yet been presented by the lecturer will allow the lecture time to be a far more interesting and in-depth discussion session, rather than a board presentation. The lecturer will be there to consolidate concepts and place them within a broader context.

Final Examination (30%): The final examination questions will be similar in style to those in the quizzes and assignments, 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 (http://www.timetables.mq.edu.au/). 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 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
Final examination	30%	No	University Examination Period
Project-based assignments	25%	No	Week 5 and Week 12
Class presentation	30%	No	Week 7 and Week 13
Weekly quizzes	15%	No	Approximately once every 3 weeks

Final examination

Assessment Type [1]: Examination Indicative Time on Task [2]: 20 hours Due: **University Examination Period** Weighting: **30%**

Exam in the University Exam period covering the content from the whole unit.

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.
- communicate complex physical concepts in writing and orally.
- solve problems in real-time during class tutorials, and demonstrate solutions to peers

Project-based assignments

Assessment Type [1]: Project Indicative Time on Task [2]: 20 hours Due: **Week 5 and Week 12** Weighting: **25%**

One project in each half of the unit.

On successful completion you will be able to:

- discuss stellar pulsations and role this plays in stellar evolution and mass loss.
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- demonstrate an understanding of the dynamics of gas flows in Astrophysical environments, including magnetic fields, shocks and viscosity.
- communicate complex physical concepts in writing and orally.
- solve problems in real-time during class tutorials, and demonstrate solutions to peers
- use numerical codes to solve astrophysical problems.

Class presentation

Assessment Type [1]: Presentation Indicative Time on Task [2]: 20 hours Due: **Week 7 and Week 13** Weighting: **30%**

Leading class discussions on pre-assigned reading material

On successful completion you will be able to:

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- solve problems in real-time during class tutorials, and demonstrate solutions to peers

Weekly quizzes

Assessment Type [1]: Quiz/Test Indicative Time on Task [2]: 13 hours Due: **Approximately once every 3 weeks** Weighting: **15%**

Short weekly quizzes set at the beginning of the week.

On successful completion you will be able to:

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Weekly quizzes	15%	No	Approximately once every 3 weeks
Project-based assignments	25%	No	Week 5 & 12
Final examination	30%	No	University Examination Period

Class presentation

Assessment Type [1]: Presentation
Indicative Time on Task [2]: 20 hours
Due: **Week 7, 13**
Weighting: **30%**

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Project-based assignments

Assessment Type [1]: Project
Indicative Time on Task [2]: 20 hours
Due: **Week 5 & 12**
Weighting: **25%**

One project in each half of the unit.

On successful completion you will be able to:

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Final examination

Assessment Type [1]: Examination
Indicative Time on Task [2]: 20 hours
Due: **University Examination Period**
Weighting: **30%**

Exam in the University Exam period covering the content from the whole unit.

On successful completion you will be able to:

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Delivery and Resources

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

1) The physical interpretation of astronomical observations, the physics of the interstellar medium, and the astrophysics of accreting gas in star formation (~6.5 weeks, lecturer Tayyaba Zafar)

2) Stellar Evolution, Pulsations, and Nucleosynthesis (~6.5 weeks, lecturer Devika Kamath)

Each part will be assessed via quizzes, oral presentations and assignments 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 devika.kamath@mq.edu.au or tayyaba.zafar@mq.edu.au from your university email address.

COVID Information

For the latest information on the University's response to COVID-19, please refer to the Coronavirus infection page on the Macquarie website: https://www.mq.edu.au/about/coronavirus-faqs. Remember to check this page regularly in case the information and requirements change during semester. If there are any changes to this unit in relation to COVID, these will be communicated via iLearn.

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

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. While no changes to the unit delivery are planned, we remain committed to improving support and student engagement.

Unit information based on version 2024.02 of the Handbook