ASTR3020

Extragalactic Astronomy and Cosmology

Session 2, In person-scheduled-weekday, North Ryde 2023

School of Mathematical and Physical Sciences

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General Information

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Credit points
10

Prerequisites
ASTR3010 or ASTR377

Corequisites

Co-badged status

Unit description
Galaxies are vast collections of stars, gas and dust, gravitationally bound into an evolving and dynamic ecosystem of physical processes. The Milky Way Galaxy in which we live is just one of billions of galaxies in the observable Universe. This unit will look beyond our Milky Way, and examine how galaxies form and evolve over cosmic time, how we quantify and categorise their properties, and what they tell us about the Universe on the largest possible scales. Topics covered will include galaxy evolution, super-massive black holes, dark matter, dark energy, Big Bang cosmology, and gravitational waves. These topics will also be explored through practical sessions making use of public research data archives and contemporary analysis techniques.

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: Demonstrate knowledge of quantitative and qualitative galaxy morphology from a variety of observational evidence, and relate this to theories of galaxy formation and evolution.

ULO2: Explain the principle properties of stellar populations, including their evolution

with time and metallicity, and how their properties are modelled.

ULO3: Calculate the dynamical properties of stellar systems based on analytic gravitational potentials, and use these to make inferences about galaxies.

ULO4: Explain the basic qualitative principles of, and observational evidence for, current cosmological models.

ULO5: Apply metric tensors in the context of cosmological models, and understand how observations constrain different components of these models.

ULO6: Demonstrate knowledge of current galaxy formation and evolutionary theories, and the techniques used to simulate these.

General Assessment Information

This unit has a hurdle requirement, specifying a minimum standard that must be attained in the final exam. To pass this unit you must obtain a mark of at least:

- 50% in the unit overall, as well as

- 40% in the final examination.

Important information regarding the final exam: If you receive special consideration for the final exam, a supplementary exam will be scheduled after the end of the normal exam period. 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.

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. If you are given a second opportunity to sit the final examination as a result of failing to meet the minimum mark required, you will be offered that chance during the same supplementary examination period and will be notified of the exact day and time after the publication of final results for the unit.

Late submission of written assessments.

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.

Assessments where Late Submissions will be accepted

In this unit, late submissions for Assignments and Lab reports will be accepted, with the Standard Late Penalty applied.

Assessment Tasks

Name	Weighting	Hurdle	Due
Lab report	30%	No	Weeks 2, 4, 7, 10, 12
Final Exam	50%	Yes	Exam period
Assignments	20%	No	Weeks 3, 6, 9, 12

Lab report

Assessment Type [1]: Lab report
Indicative Time on Task [2]: 5 hours
Due: **Weeks 2, 4, 7, 10, 12**
Weighting: **30%**

Each lab project will be assessed using the electronically submitted python notebooks directly. These are mostly completed during the lab sessions, so only a small amount of additional time is needed to prepare these for submission.

On successful completion you will be able to:

- Explain the principle properties of stellar populations, including their evolution with time and metallicity, and how their properties are modelled.
- Calculate the dynamical properties of stellar systems based on analytic gravitational potentials, and use these to make inferences about galaxies.
- Explain the basic qualitative principles of, and observational evidence for, current cosmological models.

Final Exam

Assessment Type [1]: Examination
Indicative Time on Task [2]: 30 hours
Due: **Exam period**
Weighting: **50%**

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

A final exam held during the University exam period will be used to assess skills and knowledge developed over the entire unit.

On successful completion you will be able to:

- Demonstrate knowledge of quantitative and qualitative galaxy morphology from a variety of observational evidence, and relate this to theories of galaxy formation and evolution.
- Explain the principle properties of stellar populations, including their evolution with time and metallicity, and how their properties are modelled.
- Calculate the dynamical properties of stellar systems based on analytic gravitational potentials, and use these to make inferences about galaxies.
- Explain the basic qualitative principles of, and observational evidence for, current cosmological models.
- Apply metric tensors in the context of cosmological models, and understand how observations constrain different components of these models.
- Demonstrate knowledge of current galaxy formation and evolutionary theories, and the techniques used to simulate these.

Assignments

Assessment Type [1]: Problem set
Indicative Time on Task [2]: 40 hours
Due: **Weeks 3, 6, 9, 12**
Weighting: **20%**

There will be four problem-set assignments given through the semester: two for the first half of the course, focussed on galaxies; and two for the second half, focused on cosmology. The assignments will be based on the lecture content, and are designed to deepen students' understanding of the course content, and develop problem-solving skills. Each assignment will be equally weighted. Feedback on submitted work will be provided to each student, along with worked solutions posted on iLearn.

On successful completion you will be able to:

- Demonstrate knowledge of quantitative and qualitative galaxy morphology from a variety

of observational evidence, and relate this to theories of galaxy formation and evolution.
- Explain the principle properties of stellar populations, including their evolution with time and metallicity, and how their properties are modelled.
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- Apply metric tensors in the context of cosmological models, and understand how observations constrain different components of these models.
- Demonstrate knowledge of current galaxy formation and evolutionary theories, and the techniques used to simulate these.

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[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

Delivery and Resources

Lectures and labs will be held in-person, on-campus.

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.