ASTR3020

Extragalactic Astronomy and Cosmology

Session 2, Weekday attendance, North Ryde 2021

Department of Physics and Astronomy

Contents

Session 2 Learning and Teaching Update

The decision has been made to conduct study online for the remainder of Session 2 for all units WITHOUT mandatory on-campus learning activities. Exams for Session 2 will also be online where possible to do so.

This is due to the extension of the lockdown orders and to provide certainty around arrangements for the remainder of Session 2. We hope to return to campus beyond Session 2 as soon as it is safe and appropriate to do so.

Some classes/teaching activities cannot be moved online and must be taught on campus. You should already know if you are in one of these classes/teaching activities and your unit convenor will provide you with more information via iLearn. If you want to confirm, see the list of units with mandatory on-campus classes/teaching activities.

Visit the MQ COVID-19 information page for more detail.

General Information

Unit convenor and teaching staff
Convenor
Mark Wardle
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Co-lecturer
Richard McDermid
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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://students.mq.edu.au/important-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

Assignments will be submitted electronically. Lab sessions will be based on python via jupyter-style notebooks using Google CoLab (though notebooks can also be run locally if preferred).

The final examination is a hurdle requirement. You must obtain a mark of at least 40% in the final exam to be eligible to pass the unit. If your mark in the final examination is between 30% and 39% inclusive, you may be 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.

Assessment Tasks

Name	Weighting	Hurdle	Due
Assignments	20%	No	Weeks 3, 6, 9 and 11
Lab report	30%	No	Weeks 2, 4, 7, 10 and 12
Final Exam	50%	Yes	Exam Period

Assignments

Assessment Type [1]: Problem set
Indicative Time on Task [2]: 40 hours
Due: **Weeks 3, 6, 9 and 11**
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.
- 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.

Lab report

Assessment Type [1]: Lab report
Indicative Time on Task [2]: 5 hours
Due: **Weeks 2, 4, 7, 10 and 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.

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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 Learning Skills Unit 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, lectorials and labs will be run entirely online.

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
- Grade Appeal Policy
- Complaint Management 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

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 help you improve your marks and take control of your study.

- Getting help with your assignment
- Workshops
- StudyWise
- 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 Enquiry Service

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

If you are a Global MBA student contact globalmba.support@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.