



PHYS700

Research Frontiers in Physics and Astronomy 1

S1 Day 2019

Dept of Physics and Astronomy

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General Information

Unit convenor and teaching staff

Unit Convenor

Gavin Brennen

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E6B 2.407

Credit points

4

Prerequisites

Admission to MRes

Corequisites

Co-badged status

Unit description

This unit will engage students with research frontiers in physics and astronomy. Students will attend research seminars and journal clubs within the department's four major research centres as well as follow a directed reading program of current literature. Students will be expected to actively critique and review selected literature through reports and group discussions.

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:

Students will have improved their skills in understanding difficult and unfamiliar research material in written or spoken form.

Students will have gained insight and understanding about the context for a range of frontier activities in several research fields of physics and astronomy.

Students will have developed skills in written and oral communication of recent research results and critical analysis of those results.

Students will have developed skills and tools needed to evaluate and describe how new results sit in the context of existing knowledge and ideas, and skills in assessing the

likely impact of new research.

Students will have developed and demonstrated the technical skills needed to access and navigate the scientific literature.

Assessment Tasks

| Name | Weighting | Hurdle | Due |
|-----------------------------------|-----------|--------|---------------------------|
| <u>Journal club presentations</u> | 30% | No | Throughout session |
| <u>Journal club participation</u> | 20% | No | Throughout session |
| <u>Seminar responses</u> | 25% | No | Throughout session |
| <u>Opportunity essay</u> | 25% | No | Outline: 13/4; Essay: 8/6 |

Journal club presentations

Due: **Throughout session**

Weighting: **30%**

A journal club is a good way for a research group to stay informed of recent results. It is also an excellent way of coming to terms with a new research topic, and for researchers to broaden their understanding beyond their own focused research topic.

In this unit, with help from one of the lecturers each student will select a paper from one of the top journals: Nature, Nature Photonics, Nature Communications, Nature Physics, Physical Review Letters, Science, Optica, The Astrophysical Journal, etc. The paper should be chosen to be as accessible as possible given our limited experience and the broad range of fields we are looking at. The paper should be selected and circulated to the class at least one week before the presentation.

In preparation for the actual journal club presentation, everyone is expected to read the paper thoroughly and try to make some sense of it, even though it may be outside their field of expertise. One member presents the paper with a series of slides that typically provide some background on the group(s) who wrote the paper and their interests, the major issues in the field, a summary of the actual results, and some thoughts on their significance. The paper should be put in context of previous and current work, and the presenter should also give their own assessment of the paper in terms of the soundness, merits, quality, possible impact. Parts of the paper that were unclear (or that the presenter simply doesn't understand) can also be identified and provide a good starting point for discussion.

The presentation should take around 20 minutes **excluding** discussion - so actual journal club discussions can easily take twice this long. We will have some practice/demo examples early in the session.

Students will be assessed on:

- clarity and accuracy of the presentation
- degree to which they have investigated the background of the authors and their interests
- degree to which they have put the paper in context of previous and current research
- quality of arguments about the merits and potential impact of the work
- ideas for future directions

Each student will present twice during the term and the first (practice) journal club presentation will be worth 5% and the second journal club presentation 25%.

On successful completion you will be able to:

- Students will have improved their skills in understanding difficult and unfamiliar research material in written or spoken form.
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- Students will have developed skills in written and oral communication of recent research results and critical analysis of those results.
- Students will have developed skills and tools needed to evaluate and describe how new results sit in the context of existing knowledge and ideas, and skills in assessing the likely impact of new research.
- Students will have developed and demonstrated the technical skills needed to access and navigate the scientific literature.

Journal club participation

Due: **Throughout session**

Weighting: **20%**

Students are expected to have read the weekly journal club paper prior to the scheduled class, and to bring a copy with them.

During and following the presentation, there will be a discussion of the ideas in the paper and any unclear concepts. Students are expected to make constructive contributions to the discussion, including raising questions about elements that were unclear, making general comments about the paper, the group, or the field etc.

Participants should demonstrate that they have read and studied the paper prior to the Journal Club presentation.

Participation marks out of four for each journal club will be awarded as follows:

active participation =1/4

engaged with relevant questions and responding to discussion =2/4

proactive engagement - asking pertinent questions, clear evidence of having done homework =

3/4

Showing insight through questions, evidence of probing deeper into the paper/background = 4/4

On successful completion you will be able to:

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- Students will have gained insight and understanding about the context for a range of frontier activities in several research fields of physics and astronomy.
- Students will have developed skills in written and oral communication of recent research results and critical analysis of those results.
- Students will have developed skills and tools needed to evaluate and describe how new results sit in the context of existing knowledge and ideas, and skills in assessing the likely impact of new research.

Seminar responses

Due: **Throughout session**

Weighting: **25%**

Regular engagement with research seminars and colloquia is a very important part of being an active and engaged researcher in any department, and is a vital part of PHYS700. Students will be expected to attend a minimum of 8 seminars/colloquia and respond to those on the online forum in iLearn.

As the session progresses, we will identify weekly seminars and colloquia that are most likely to be accessible to the group. We can expect that some talks will not be easy to understand and part of this assessment is about the skill of making whatever sense we can of unfamiliar concepts.

After each seminar, students will write 250 word responses to the seminars using an iLearn forum that will be made available. These responses may take a number of forms: a summary of the key ideas, some detailed comment on a particular area of the talk, an explanation of connections to related areas you may be familiar with. Students are encouraged to provide links to additional relevant information that adds to the discussion.

Submitting these 250 word responses will then provide access to the discussion part of this forum. They will be able to read other student's responses, and then similar to the journal club, students will engage in a forum discussion of the ideas that come up using short posts. We can expect this to take place over a 2-5 days each week. Students should check in regularly to participate in the discussions.

This activity is worth 25% of the total assessment for the unit. 15% will be allocated to the 250 word responses based on insight, independent thinking. The remaining 10% will be awarded for the discussion component. We expect an average of 2 insightful and reasonably independent contributions (only a few lines each time) per seminar. Posts that depart from professional and

constructive debate will attract negative marks.

Students will be regularly advised of their individual performance on this assessment task throughout the session.

Advice on Forum Netiquette can be found here:

http://www.mq.edu.au/iLearn/student_info/netiquette.htm

On successful completion you will be able to:

- Students will have improved their skills in understanding difficult and unfamiliar research material in written or spoken form.
- Students will have gained insight and understanding about the context for a range of frontier activities in several research fields of physics and astronomy.
- Students will have developed skills in written and oral communication of recent research results and critical analysis of those results.
- Students will have developed skills and tools needed to evaluate and describe how new results sit in the context of existing knowledge and ideas, and skills in assessing the likely impact of new research.
- Students will have developed and demonstrated the technical skills needed to access and navigate the scientific literature.

Opportunity essay

Due: **Outline: 13/4; Essay: 8/6**

Weighting: **25%**

Students will prepare an essay (approximately 2000 words) on the research *opportunity* relating to a recent (less than 12 months old) research breakthrough of their choice.

All research is set in the context of what has been done before, and what may follow. Authors publishing in high profile journals often claim to have made important breakthroughs in their research. The authors may claim to be reporting research which is a major step over what has already been achieved, and thereby to have opened up many new avenues for further research. Often such papers are the starting points for other researchers who wish to follow up on these opportunities.

In this essay, students will critically evaluate the broader context of a recent research breakthrough that has been published in a high profile journal like Science or Nature, including how the research reported fits into the global picture that includes for example competing research programs tackling the same problem. Students will also critically evaluate opportunities for further research based on the breakthrough claimed in their chosen paper. An outstanding essay will not only provide both a critique of the opportunities claimed by the authors themselves, but also consider other possibilities offered by the reported breakthrough.

Essay topics must be discussed with the unit lecturers and a 1/2 page outline must be submitted

before the mid session break.

Final essays must be submitted through Turnitin on iLearn.

On successful completion you will be able to:

- Students will have gained insight and understanding about the context for a range of frontier activities in several research fields of physics and astronomy.

Delivery and Resources

Background

This unit focuses on accessing and understanding research results through seminars, colloquia and papers.

It addresses questions like

- How do we make a start on understanding unfamiliar material?
- How do we present material describing other people's results?
- How do we lead and contribute to a discussion of a third party's research work?

The key idea is that as scientists approaching new topics, the quantity and technical difficulty of material can be overwhelming. Nevertheless there are techniques that can allow us to grab footholds and start to develop a basic understanding of the material. In this unit, we will do this many times by encountering new research in several forms (papers, talks etc); following it up online by looking for further literature and other information; and reporting our conclusions in different ways: journal club discussions, short blogs and discussion fora.

Amongst other things we will try to evaluate:

- novelty and potential impact
- wider context of the work
- probable correctness
- quality of presentation

We will also think about the ways scientific research is a *human* activity. This has implications for how scientists and teams of scientists plan their projects over a series of papers, and what are appropriate ways for us as consumers of scientific reporting to discuss and critique the work of others. We will also discuss factors around the process of publication, including the peer review process, research funding and careers which are all linked to the overall enterprise of research as captured through the Academic Literature.

The intention of this unit is that it should be unfamiliar and demanding, but rewarding. The skills developed and assessed are entirely different from any other unit this year. If you put in the time, it should be very achievable to perform well.

This is also a unit where discussion and (respectful) exchange of opinions is central. The more each of us puts in, the more fun we will have.

Class timetable

Main tutorial/workshop

The current plan is to schedule a 2-hour workshop each week, with the main activity to be journal clubs and discussion of those.

The first workshop will be an introduction session on Monday 26th February (Week 1) from 4-6pm in 3 Innovation Rd (EMC) G230 Faculty Tute Room.

In week 2, we will explain to you how a good Journal club presentation should look like and one of your lecturers will also present a sample Journal club talk.

From week 3 onwards, the floor is yours. One or two students will present a journal club of around 20-25 minutes at each session and lead a discussion of the paper.

Other topics related to seminars we've seen may come up from time to time.

Technologies used and resources

Part of the unit will involve online searching and accessing of current literature.

Changes in delivery

No significant changes.

Policies and Procedures

Macquarie University policies and procedures are accessible from [Policy Central \(https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central\)](https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central). 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](#) (**Note:** *The Special Consideration Policy is effective from 4 December 2017 and replaces the Disruption to Studies Policy.*)

Undergraduate students seeking more policy resources can visit the [Student Policy Gateway](https://students.mq.edu.au/support/study/student-policy-gateway) (<https://students.mq.edu.au/support/study/student-policy-gateway>). It is your one-stop-shop for the key policies you need to know about throughout your undergraduate student journey.

If you would like to see all the policies relevant to Learning and Teaching visit [Policy Central](http://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central) (<http://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central>).

Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: <https://students.mq.edu.au/study/getting-started/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

Submission Deadlines

All deadlines are strict - extensions will only be granted by agreement with the Unit Convenor prior to the deadlines.

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 improve your marks and take control of your study.

- [Workshops](#)
- [StudyWise](#)
- [Academic Integrity Module for Students](#)
- [Ask a Learning Adviser](#)

Student Services and 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.

Student Enquiries

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

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.

Graduate Capabilities

PG - Capable of Professional and Personal Judgment and Initiative

Our postgraduates will demonstrate a high standard of discernment and common sense in their professional and personal judgment. They will have the ability to make informed choices and decisions that reflect both the nature of their professional work and their personal perspectives.

This graduate capability is supported by:

Learning outcomes

- Students will have gained insight and understanding about the context for a range of frontier activities in several research fields of physics and astronomy.
- Students will have developed skills in written and oral communication of recent research results and critical analysis of those results.
- Students will have developed skills and tools needed to evaluate and describe how new results sit in the context of existing knowledge and ideas, and skills in assessing the likely impact of new research.
- Students will have developed and demonstrated the technical skills needed to access and navigate the scientific literature.

Assessment tasks

- Journal club presentations
- Journal club participation
- Seminar responses

PG - Discipline Knowledge and Skills

Our postgraduates will be able to demonstrate a significantly enhanced depth and breadth of knowledge, scholarly understanding, and specific subject content knowledge in their chosen fields.

This graduate capability is supported by:

Learning outcomes

- Students will have improved their skills in understanding difficult and unfamiliar research

material in written or spoken form.

- Students will have gained insight and understanding about the context for a range of frontier activities in several research fields of physics and astronomy.
- Students will have developed skills in written and oral communication of recent research results and critical analysis of those results.
- Students will have developed skills and tools needed to evaluate and describe how new results sit in the context of existing knowledge and ideas, and skills in assessing the likely impact of new research.
- Students will have developed and demonstrated the technical skills needed to access and navigate the scientific literature.

Assessment tasks

- Journal club presentations
- Journal club participation
- Seminar responses
- Opportunity essay

PG - Critical, Analytical and Integrative Thinking

Our postgraduates will be capable of utilising and reflecting on prior knowledge and experience, of applying higher level critical thinking skills, and of integrating and synthesising learning and knowledge from a range of sources and environments. A characteristic of this form of thinking is the generation of new, professionally oriented knowledge through personal or group-based critique of practice and theory.

This graduate capability is supported by:

Learning outcomes

- Students will have improved their skills in understanding difficult and unfamiliar research material in written or spoken form.
- Students will have gained insight and understanding about the context for a range of frontier activities in several research fields of physics and astronomy.
- Students will have developed skills and tools needed to evaluate and describe how new results sit in the context of existing knowledge and ideas, and skills in assessing the likely impact of new research.
- Students will have developed and demonstrated the technical skills needed to access and navigate the scientific literature.

Assessment tasks

- Journal club presentations

- Journal club participation
- Seminar responses
- Opportunity essay

PG - Research and Problem Solving Capability

Our postgraduates will be capable of systematic enquiry; able to use research skills to create new knowledge that can be applied to real world issues, or contribute to a field of study or practice to enhance society. They will be capable of creative questioning, problem finding and problem solving.

This graduate capability is supported by:

Learning outcome

- Students will have improved their skills in understanding difficult and unfamiliar research material in written or spoken form.

Assessment tasks

- Journal club presentations
- Journal club participation
- Seminar responses
- Opportunity essay

PG - Effective Communication

Our postgraduates will be able to communicate effectively and convey their views to different social, cultural, and professional audiences. They will be able to use a variety of technologically supported media to communicate with empathy using a range of written, spoken or visual formats.

This graduate capability is supported by:

Learning outcome

- Students will have developed skills in written and oral communication of recent research results and critical analysis of those results.

Assessment tasks

- Journal club presentations
- Journal club participation
- Seminar responses
- Opportunity essay

PG - Engaged and Responsible, Active and Ethical Citizens

Our postgraduates will be ethically aware and capable of confident transformative action in

relation to their professional responsibilities and the wider community. They will have a sense of connectedness with others and country and have a sense of mutual obligation. They will be able to appreciate the impact of their professional roles for social justice and inclusion related to national and global issues

This graduate capability is supported by:

Learning outcomes

- Students will have gained insight and understanding about the context for a range of frontier activities in several research fields of physics and astronomy.
- Students will have developed skills and tools needed to evaluate and describe how new results sit in the context of existing knowledge and ideas, and skills in assessing the likely impact of new research.

Assessment tasks

- Journal club presentations
- Journal club participation
- Seminar responses