

School of Physics and Astronomy
University of Edinburgh



Astronomy

2011/2012

Course Information:
Discovering Astronomy
Astronomy 1G: Galactic and Cosmological Science

September 2011

ASTRONOMY COURSES 2011-2012

This booklet contains important information about your course; please read it carefully, then keep it with your notes so that you can refer to it as the course progresses.

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The course web page can be accessed by registered students through the MyEd portal:

www.myed.ed.ac.uk

Revision Sept 2011

The Course Organisers have tried to ensure that information given in this booklet is correct at the time of printing. Any alterations or amendments that prove necessary will be notified through the course web pages and posted on the Astronomy 1 notice board in the Appleton Tower concourse.

K. Rice

C. Heymans

Course Structure

Discovering Astronomy is accessible to students taking a variety of courses. It is an introduction to stars, planets, the Solar System, the Milky Way galaxy, other star systems and cosmology.

Astronomy 1G: Galactic and Cosmological Science is aimed at scientists, and is recommended, for example, to be taken by those students registered for Astrophysics. It concentrates on the physics and appearance of galaxies and our current understanding of the universe that we inhabit. This course only runs every alternate year.

In the 2012/2013 academic year, the course offered will be:

Astronomy 1S: Stellar and Planetary Science is aimed at scientists and is recommended, for example, to be taken by those students registered for Astrophysics. It concentrates on the physics and life story of stars and planets and how this illuminates our understanding of the Universe.

Each of these courses is designed in its own right to be exciting, up to date, and a rounded introduction to the ideas, methods and results of astronomy, taught by staff actively engaged at these frontiers. The Astronomy 1 courses, aimed at scientists (with mathematical background), are designed so that they can be taken in successive years to provide a more complete picture of the subject; The Discovering Astronomy course is aimed at non-scientists with a little mathematical background.

Enthusiasts can consider taking Astronomy 1G in 2011/2012 followed by Astronomy 1S in 2012/2013. Discovering Astronomy, however, is a standalone course and cannot be counted for credit together with Astronomy 1G or Astronomy 1S.

Entry Requirements

These half courses do not have a formal entry requirement. However, for entry to Astronomy 1, prior attendance at a physical science course to SCE Higher Grade or equivalent is required. Some simple calculus is used in parts of Astronomy 1, and the underlying physics is discussed throughout the course. Complicated mathematics will not be used in Discovering Astronomy, but students are expected to be able to perform simple arithmetic and to understand basic geometry and simple algebra.

Contacts

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Course Home Page

The course home page is available on WebCT and can be accessed by registered students only through the MyEd portal (www.myed.ed.ac.uk). This website will include interactive course material, copies of the lecture notes, and self-test problems. All notices, announcements, and assessment grades will also be posted on this website, and there will be a discussion board allowing students to ask questions about the course or to provide feedback.

Registration

In addition to formal registration through your Director of Studies, you **must** also complete a course registration form; these are on the web **at the URL above**. Paper copies will be available at the first few lectures, and **should be returned promptly** so that tutorial groups can be arranged.

Timetable

Astronomy 1S and 1G run in the second semester, Discovering Astronomy in the first. Lectures and tutorials are scheduled on Monday and Friday afternoons. Full details are given in this booklet and may be updated on the course web pages.

Workload

In summary, **each** course has:

- ⊙ 30 contact hours
- ⊙ 5 tutorials (1 every two weeks) on Monday/Friday at 3pm, some including assessed work. This assessed work will count towards the final mark
- ⊙ 1 coursework exercise to be handed in (assessed and counts towards the final mark)
- ⊙ self-assessment problem sheets (also strongly recommended)
- ⊙ degree examination at the end of the course

Observing

Free tickets for the Visitor Centre's public observing sessions on Friday nights will be available for first year students interested in some stargazing and perhaps thinking about getting involved in outreach work. These tickets are limited and booking is essential. Contact the Visitor Centre (0131 668 8404, 2-4pm, vis@roe.ac.uk).

Tutorials

Each student will attend a total of 5 tutorials, 1 every 2 weeks. Tutorials will be held on Mondays and Fridays from 15.00 to 15.50, and students will be divided into groups during the first week. If you have a preference for a particular day, this can be noted on the registration form.

During these tutorial sessions, students will work in groups to answer questions that will be similar to those that you will see in the exam. At the end of each two week period students will hand in their solutions and three of these solutions will be assessed. The best 4 tutorial marks out of 5 will count towards your final degree mark. Students are encouraged to hand in all 5 sets of tutorial solutions, but by using the best 4 out of 5 means that students can miss one tutorial, if necessary, without being penalised. The tutorial deadlines will generally be the first lecture on the Monday after the final tutorial of each two week period. The exact dates of these lectures are shown in the timetables at the end of this booklet. **We will not accept work that is handed in after these deadlines.**

NO MARKS WILL BE GIVEN FOR TUTORIAL WORK THAT IS HANDED IN WITHOUT A BARCODE

In semester 1, the first tutorial session for Discovering Astronomy will start on the Monday of Wk 2 (26th September). We may have to ask students to volunteer for this session during the first lecture which will be on the previous Friday. In semester 2, the first session for Astronomy 1G tutorial will be at the beginning of week 2 (23rd January).

Textbooks

The Astronomy 1 course material does not follow a single textbook closely. A suitable first year level textbook is:

M Zeilik, S A Gregory, "Introductory Astronomy and Astrophysics", Saunders College Publishing (fourth edition, 1998).

The recommended textbook for Discovering Astronomy is

J Bennett, M Donahue, N Schneider, M Voit, "The Cosmic Perspective",
Pearson/Addison Wesley (fourth edition, 2006).

Individual lecturers may recommend supplementary material from time to time; copies of this, and a few copies of the textbook, are usually available for consultation in the main library reading room.

Self-Assessment

Answer sheets for all of the problems will be made available, so that you can check your work. If you have difficulties with the problems set, you should contact a member of staff in the tutorials.

Self-test problems will also be available on the course website on WebCT that can be accessed through the MyEd portal (www.myed.ed.ac.uk).

You are also expected to read through your lecture notes and handouts, and to read appropriate sections of the textbook. It is important that you wrestle with any difficulties yourself before coming back to us if you are still stuck.

Assessed Coursework

In each Astronomy course you will be asked to hand in an assignment by the specified date given in the detailed timetable information towards the end of this booklet. Details of the assignment (which may be essay, poster or numerical work) will be given several weeks in advance. You will have a choice of options for each assignment.

You *must* complete the coursework and hand it in *on time*. It will be marked and returned to you; there is a marking *penalty of 5% per working day*, for five days, with a mark of zero thereafter, for late work. *The assessed coursework is included in the final mark for the course*; see 'What is required to pass the course' below for details of how this is done. This means that any *marks lost for late coursework make it harder to pass the course*.

NO MARKS WILL BE GIVEN FOR COURSEWORK THAT IS HANDED IN WITHOUT A BARCODE

You must include a signed "Own Work Declaration" form when handing in the coursework. A mark will not be given if this form is not signed and returned with your work. The form is available from the courses web page on WebCT or can be downloaded from the School's website:

www.ph.ed.ac.uk/courseinfo/undergrad/Forms/plagiarism-declaration.pdf

Clickers

We will be using clickers (formally known as a Personal Response System) in both Discovering Astronomy and Astronomy 1G. If you don't already have a clicker, you will be able to collect one after the first lecture. The use of the clickers will be essentially anonymous and they will be used primarily to promote some interaction during the lectures, and to give the teaching staff some idea of how well the class as a whole understands the material that is being taught.

Examinations

The examination for Discovering Astronomy has the following format:

- A two hour exam consisting of a multiple choice section, a short questions section and a problem-solving section.

The examinations for the Astronomy 1G and Astronomy 1S have the following format:

- A two hour exam consisting of a short questions section and a problem-solving section.

Degree examination papers - but not multiple choice sections - for previous years are available (see our web pages). Departmental calculators will be issued for use in the examinations.

What is Required to Pass the Course

The course grade and pass/fail will result from the degree examination mark (or August re-sit), the assessed tutorial problems and the coursework marks. Note that, to be awarded a pass on the course, in addition to achieving the *overall* pass mark (40% on the University Common Marking scale) you must score a minimum of 40% on the Degree Examination itself. A student that scores 40% overall, but scores less than 40% on the Degree Examination will fail with a U grade. The overall pass mark is calculated from:

- 2/3 examination
- 1/6 coursework assignment
- 1/6 assessed tutorial problems

Plagiarism

The University regulations in relation to plagiarism are detailed in Section 14 of the *Undergraduate Assessment Regulations*; these are available on-line at:

<http://www.aaps.ed.ac.uk/regulations/exam.htm>

The following are extracts from section 14 of the 2008/2009 regulations:

14.1 Plagiarism is the act of copying or including in one's own work, without adequate acknowledgement, intentionally or unintentionally, the work of another. It is academically fraudulent and an offence against University discipline. Plagiarism, at whatever stage of a student's course, whether discovered before or after graduation, will be investigated and dealt with appropriately by the University.

14.2 All work submitted for assessment by students is accepted on the understanding that it is the student's own effort without falsification of any kind. Students are expected to offer their own analysis and presentation of information gleaned from research, even when group exercises are carried out. In so far as students rely on sources, they should indicate what these are according to the appropriate convention in their discipline. The innocent misuse or citation of material without formal and proper acknowledgement can constitute plagiarism, even when there is no deliberate intent to cheat. Work may be plagiarised if it consists of close paraphrase or unacknowledged summary of a source, as well as word-for-word transcription. Any failure adequately to acknowledge or properly reference other sources in submitted work could lead to lower marks and to disciplinary action being taken.

The submission of all continually assessed work* that count towards Degree Examinations must be accompanied with a signed copy of the *University of Edinburgh - Own Work Declaration* form, a copy of which is included in the appendices. This form is also available for download from

<http://www.ph.ed.ac.uk/teaching/>

in either PDF or Microsoft Word format. Paper copies are also available from the *Teaching Office* and laboratory technicians.

Group Work or *Team Review* reports must be accompanied by a single declaration signed all of the group members.

Note all submitted continually assessed work* is retained by the School for four months after the meeting of the Board of Examiners assessing this work. It is then securely destroyed. Neither originals or copies can be returned. It is recommended that students make a copy of their work prior to submission.

**this does not include weekly hand-ins*

Disability and Specific Learning Difficulties

The University has a duty under the *Disability Discrimination Act 1995* to make 'reasonable adjustments' for students who are disabled. Please feel free to discuss any requirements you have with your *Director of Studies*. They may refer you on to the *Disability Office*, or you can contact them at any time yourself at:

Student Disability Service
The University of Edinburgh
6-8 South College Street
Edinburgh EH8 9AA

Telephone: 0131 650 6828

Textphone: 0131 650 9371

Email: disability.service@ed.ac.uk

<http://www.ed.ac.uk/schools-departments/student-disability-service>

Before any specific adjustments can be made the University requires evidence of either disability (usually a letter from your GP) or learning difficulty (a diagnostic assessment from a Chartered Educational Psychologist). The Disability Office can advise on this. Once the Disability Office receives your evidence they will carry out a needs assessment and develop a personalised *Learning Profile* which will contain specific adjustments, for example extra examination time, large print course notes etc. This profile will be communicated by the *Disability Office* to the School, your Director of Studies and to *Registry*. The School will endeavour to comply with its conditions in a timely manner. The content of this *Learning Profile* will, where practical, be kept confidential, but to supply the required assistance it is necessary to pass on some details, in particular the adjustments that need to be made, to *Course Coordinators*, *Course/Laboratory Organisers* and *Teaching Office* staff. Students should discuss with the *Disability Office* if there are parts of their *Learning Profile* they wish to be kept strictly confidential. Students registered under this scheme should check with the *School Teaching Administrator* at the start of Semester 1 that suitable arrangements have been put in place.

Students with specific learning difficulties that affect continuously assessed work, for example project reports, essays, weekly hand-ins, etc, have been issued with stickers which they can attach to the front cover of such submitted work. See the *Disability Office* web site for details of this scheme.

Students with short term disability, for example as a result of accident or injury, may also seek assistance from the *Disability Office*, either directly or via their *Director of Studies*. For minor incidents, back copies of missed lectures etc. can be obtained from the *Course Organiser* or the *School Teaching Administrator*.

Appeals

The University has two official channels for resolution of student grievances, these being the *Student Complaints Procedure* to deal with non-examination related issues and the *University Appeals Procedure* to deal with examination issues and results.

Student Complaints Procedure: Full details of the Student Complaints Procedure can be found online at:

www.aaps.ed.ac.uk/regulations

A paper copy of this document is also available from the Teaching Office of the School of Physics.

Appeals Procedure: The formal University appeals procedure is detailed in the Degree Examination Regulations at:

www.aaps.ed.ac.uk/regulations/exam.htm

Students considering a complaint or appeal are strongly advised to discuss the matter with their Director of Studies or with the Head of School.

Student Feedback

We strongly encourage student feedback as this is the primary way in which we can improve the course and how it is presented to you. You can provide feedback by going directly to the lecturer, by talking to your class representative, who will be elected during the first lecture, by filling in the questionnaires that will be handed out at the end of each section, or by using the WebCT discussion boards.

Data Protection

Personal information related to the course will be held and used within the constraints of the University's data protection registration.

Discovering Astronomy

19 September to 02 December

Monday 14.00 George Square Theatre
Monday 16.10 Appleton Tower, LT5
Friday 14.00 David Hume Tower LTA

Wk	Date	Day/Time	Module	Lecturer
1	19 Sep	M2, M4	Introduction; The origins of Astronomy	Prof AS Trew
1	23 Sep	F2	Kepler's Law	
2	26 Sep	M2, M4	Newton's Laws;	
	30 Sep	F2	Special and General Relativity	
3	03 Oct	M2, M4	Quantum Mechanics	
	07 Oct	F2	Telescopes;	
4	10 Oct	M2, M4	Stars and the Hertzsprung-Russel Diagram 10 Oct, M2: Tutorial 1 deadline Coursework assignment set: Monday 10 Oct.	
	14 Oct	F2	The Structure of Stars	
5	17 Oct	M2, M4	The Sun	Dr K Rice
	21 Oct	F2	The Solar System	
6	24 Oct	M2*, M4	Planets, comets, asteroids *24 Oct, M2: Tutorial 2 deadline.	
	28 Oct	F2	Star and Planet formation	
7	31 Oct	M2, M4	Extrasolar Planets	
	04 Nov	F2	The evolution of stars: high-mass and low-mass	
8	07 Nov	M2*, M4	Star Death, White dwarfs, Neutron stars, Black Hole *07 Nov, M2: Tutorial 3 deadline.	
	11 Nov	F2	Milky Way Galaxy *11 Nov, F2: Coursework deadline.	Prof A Lawrence
9	14 Nov	M2, M4	The Local Group	
	18 Nov	F2	The formation of structure	
10	21 Nov	M2*, M4	The formation of galaxies *21 Nov, M2: Tutorial 4 deadline.	
	25 Nov	F2	The early Universe	
11	28 Nov	M2, M4	The Big Bang	
	02 Dec	F2	Cosmology 02 Dec, F2: Tutorial 5 deadline.	
12	5-9 Dec		Revision Week	
	12-21 Dec		Examinations	

Tutorials: at 3pm on Monday and Friday. The class will be organised into 8 groups. Each group will get 5 tutorials sessions; details of dates, times and locations for each group will be posted in the course web pages.

Course requirements: We expect you to attend all the lectures and tutorials provided for you. The lectures present a guide to the material and set out the foundations of the course in the way that it will be examined (the lecturers are the examiners). The material covered by the exercises undertaken in the tutorials is intended to complement the lectures and may also be examined.

Synopsis : Discovering Astronomy

Introduction (12 Lectures – Prof. Trew)

There will be 12 introductory lectures presented by Prof. Trew. These will cover topics such as

- The origins of Astronomy
- Kepler's Laws
- Newton's Laws
- Special and General Relativity
- Quantum Mechanics
- Telescopes
- Stars and the Hertzsprung-Russell Diagram
- The structure of Stars.

Stars and Planets (12 Lectures – Dr Rice)

There will be 12 lectures, presented by Dr Rice, that will focus primarily on stars and planets. Topics covered will be

- The Sun
- The Solar System
 - Planets, comets, asteroids
- Star and Planet formation
- Extrasolar Planets
- The evolution of stars
 - High-mass and low-mass stars
- Star death
- White dwarfs, Neutron stars, Black Holes

Galaxies and Cosmology (9 Lectures – Prof. Lawrence)

The course will finish with 9 lectures, presented by Prof. Lawrence, that will discuss galaxies and cosmology. This will include topics such as

- The Milky Way Galaxy
- The Local Group
- The formation of structure
- The formation of galaxies
- The early universe
- The Big Bang
- Cosmology

Astronomy 1G: Galactic and Cosmological Science

11 January to 26 March

Monday 14.00 Appleton Tower, LT5
Monday 16.10 Appleton Tower, LT5
Friday 14.00 David Hume Tower, LTA

Wk	Date	Module	Lecturer
1 & 2	16 Jan	THE SCIENCE OF ASTRONOMY	Prof A Lawrence
3 & 4	30 Jan	THE MILKY WAY AND OTHER GALAXIES	Prof A Lawrence
		06 Feb, M2: Tutorial 1 deadline Coursework assignment set: Monday 06 Feb.	
5	03 Feb	ACTIVE GALAXIES	Dr K Rice
		17 Feb, F2: Tutorial 2 deadline.	
6	20-24 Feb	INNOVATIVE LEARNING WEEK	
7	27 Feb	BLACK HOLES	Dr K Rice
8 & 9	05 Mar	GALAXIES AT LARGE	Prof A Lawrence
		05 Mar, M2: Tutorial 3 deadline 09 Mar, F2: Coursework deadline	
10 & 11	19 Mar	COSMOLOGY	Dr C Heymans
		19 Mar, M2: Tutorial 4 deadline	
	30 Mar	30 Mar, F2: Tutorial 5 deadline.	
12	02 Apr	Short practice exam in M2, feedback in M4	
	30 Apr – 25 May	Examinations	

Tutorials: at 3pm on Monday and Friday. The class will be organised into 8 groups. Each group will get 5 tutorials; details of dates, times and locations for each group will be posted in the course web pages.

Course requirements: We expect you to attend all the lectures and tutorials provided for you. The lectures present a guide to the material and set out the foundations of the course in the way that it will be examined (the lecturers are the examiners). The material covered by the exercises undertaken in the tutorials is intended to complement the lectures and may also be examined.

Synopsis: Astronomy 1G

The Science of Astronomy (Prof. A Lawrence) (Wks 1 & 2)

Lecture-1 : Principles of Astronomical Science; Whirlwind Tour of the Universe

Lecture-2 : Gravity and Motion

Lecture-3 : Radiation and Matter

Lecture-4 : Astrophysical Spectra

Lecture-5 : Distances and Magnitudes

Lecture-6 : Properties of the Stars

The Milky Way and Other Galaxies (Prof. A Lawrence) (Wks 3 & 4)

Lecture-1 : Overview of the Milky Way

Lecture-2 : Stellar Populations in the Milky Way

Lecture-3 : Gas, dust, and dark matter in the Milky Way

Lecture-4 : Size, dynamics, and history of the Milky Way

Lecture-5 : Other galaxies : types, shapes, and contents

Lecture-6 : Dynamics and masses : first clues to galaxy formation

Active Galaxies and Black Holes (Dr K Rice) (Wks 5 & 7)

Lecture-1: The Physics of Black Holes

Lecture-2: Properties of Black Holes

Lecture-3: Stellar-ass Black Holes

Lecture-4: Supermassive Black Holes

Lecture-5: Active Galaxies

Lecture-6: Energy extraction from Black Holes

Galaxies at Large (Prof. A Lawrence) (Wks 8 & 9)

Lecture-1 : Cosmography : the geography and demography of galaxies

Lecture-2 : Clustering of galaxies

Lecture-3 : Galaxy distances and the Hubble flow

Lecture-4 : Collisions and mergers

Lecture-5 : Distant galaxies and quasars

Lecture-6 : The formation of galaxies

Cosmology (Dr C Heymans) (Wks 10 & 11)

Lecture-1: The Expanding Universe

Lecture-2: The Big Bang and Inflation

Lecture-3: The Cosmic Microwave Background Radiation

Lecture-4: Nucleosynthesis

Lecture-5: The Dark Side of the Universe

Lecture-6: What the future may hold for the Universe