

## ***Astronomy and Philosophy: PHI1AAP and PHI2HPSA***

### **Subject information at a glance**

<b>PHI1AAP, credit points: 15</b> <b>Bundoora, semester: 1</b>	<b>PHI2HPSA, credit points 20</b> <b>Bundoora, semester: 1</b>
<b>Subject Description:</b> This subject aims to explore and examine what we understand by science. While science and technology are essential aspects of contemporary life, it may not be clear exactly what counts as scientific work, and how science is to be distinguished from practices which are thought to be unscientific. For example, what makes astronomy different from astrology? In this subject, we examine the development of science, and try to identify the central elements of what we might call the modern scientific approach. We will look at a large range of ideas about the stars and planets, and trace the advance to Newtonian physics from pre-scientific myths about the universe. We will also discuss philosophical accounts of these ideas and discoveries in order to explore what might be meant by the notion of science.	
<b>Academic &amp; Support Staff:</b>  <b>Unit Co-ordinator</b> Dr Philipa Rothfield, HU2 Rm 206, ph: 9479 2541 Email: <a href="mailto:p.rothfield@latrobe.edu.au">p.rothfield@latrobe.edu.au</a>	<b>Administrative Officer</b> Roger Palmer, Philosophy Program Office, HU2 Rm 316, ph: 9479 1673, Email: <a href="mailto:r.palmer@latrobe.edu.au">r.palmer@latrobe.edu.au</a>  <b>Postal Address:</b> Philosophy Program, CACE La Trobe University, VIC 3086 <a href="http://www.latrobe.edu.au/www/philosophy/">http://www.latrobe.edu.au/www/philosophy/</a>
<b>Your lecturers in this unit:</b> Mr John Fox, room HU2 305 <a href="mailto:j.fox@latrobe.edu.au">j.fox@latrobe.edu.au</a> phone: 9479 2986 Dr Luca Moretti room HU2 306 <a href="mailto:l.moretti@latrobe.edu.au">l.moretti@latrobe.edu.au</a> Dr Edoardo Zamuner room HU2 310 <a href="mailto:e.zamuner@latrobe.edu.au">e.zamuner@latrobe.edu.au</a>	
<b>Delivery mode, location &amp; times:</b>  <b>LECTURES</b> -- <u>There are two one-hour lectures in this subject. You need to attend both the lectures:</u> Mondays 10am ELT 5 <b>and</b> Mondays 1pm ELT5  <b>TUTORIALS</b> -- <u>You need to enrol in ONE Tutorial (tutorials start in the 2<sup>nd</sup> week of semester):</u> Mondays 2-3pm HUED108 Mondays 3-4pm HUED 108 Tuesdays 1-2pm DWB 132 Tuesdays 2-3pm GS228  <b>You should enrol in a tutorial online using OASIS, an online tutorial enrolment system:</b> To connect to OASIS, use <a href="http://www.latrobe.edu.au/oasis">http://www.latrobe.edu.au/oasis</a>  <b>Learning Management System on-line support:</b> For written information and lectopia recorded lectures, go to <a href="https://webct.latrobe.edu.au">https://webct.latrobe.edu.au</a>	
<b>Assessment for PHI1AAP:</b> - FOUR short answer exercises (800 words equivalent) worth 20% (short answer exercises are to be handed to your tutor in class) - One 1,200 word essay worth 30%: due <b>Monday 4<sup>th</sup> May</b> (Essays are to be handed to the Philosophy Program Office: HU2 Rm 316) - One hour test worth 20% - One hour exam worth 30%	

**Assessment for PHI2HPSA:**

- FOUR short answer exercises (1,000 words equivalent) worth 20%  
(short answer exercises are to be handed to your tutor in class)
- One 2,000 word essay worth 30%: due **Monday 4<sup>th</sup> May**  
(Essays are to be handed to the Philosophy Program Office: HU2 Rm 316)
- One hour test worth 20%
- One hour exam worth 30%

**Essential texts and Required readings are available from the bookshop and on library reserve:**

**Required text:** Thomas Kuhn, *The Copernican Revolution*, Cambridge, USA: Harvard University Press, 1957.

**Required reader (with source material):** PHI1AAP and PHI2HPSA *Astronomy and Philosophy Reader (Source Materials and Notes)* 2009.

**Please see:**

[http://www.latrobe.edu.au/philosophy/resources\\_ug/index.html](http://www.latrobe.edu.au/philosophy/resources_ug/index.html) on the rights and responsibilities of students enrolled in philosophy and for advice on writing philosophy essays.

## **Section 1: Learning in this Subject**

### **Subject Description**

This subject aims to explore and examine what we understand by science. While science and technology are essential aspects of contemporary life, it may not be clear exactly what counts as scientific work, and how science is to be distinguished from practices which are thought to be unscientific. For example, what makes astronomy different from astrology? In this subject, we examine the development of science, and try to identify the central elements of what we might call the modern scientific approach. We will look at a large range of ideas about the stars and planets, and trace the advance to Newtonian physics from pre-scientific myths about the universe. We will also discuss philosophical accounts of these ideas and discoveries in order to explore what might be meant by the notion of science.

### **Aims & expected learning outcomes**

The aim of this subject is to give students (1) knowledge and understanding of philosophical approaches to the abovementioned issues and (2) a range of skills or capacities, sometimes called “generic skills”, meaning that they are skills which are useful in other disciplines as well as in philosophy, and indeed are useful in your future employment, and in life in general. Here are some of the generic skills that the subject’s learning activities will encourage you to develop:

- 1) Time management skills
- 2) Effective writing skills
- 3) Problem solving skills.
- 4) The ability to work independently, and form your own reasoned judgment about a complex issue.
- 5) The ability to keep points relevant to the issue at hand
- 6) The ability to evaluate evidence and arguments.
- 7) The ability to evaluate a theory or view on some important and contested matter.
- 8) The ability to state points with maximum clarity and precision.
- 9) The ability to locate information relevant to the question at hand.
- 10) The ability to produce a clearly structured piece of writing.

You will be given advice through the subject on how to develop these skills.

### **Subject Structure**

#### **How the aims and learning outcomes will be achieved**

<b>Week and lecture topics</b>	<b>Staff member</b>
1 <b>Introduction</b> and Early Observations; the “two-sphere” universe; geometry	Dr Philipa Rothfield Mr John Fox
2 Arguments; Aristotle’s picture; the problem of the planets; Eudoxos	Mr John Fox
3 Difficulties; Alternatives (Pythagoreans, Atomists...); Ptolemy and epicycles	Mr John Fox

4 More Ptolemy (equants, eccentrics...); Middle Ages: Buridan, Oresme	Mr John Fox
5 Copernicus' Theory	Dr Edoardo Zamuner
6 Rationality of Copernicus' theory	Dr Edoardo Zamuner
7 The Copernican Revolution	Dr Edoardo Zamuner
8 Scientific methodology & Inductivism	Dr Luca Moretti
9 Popper's Falsificationism	Dr Luca Moretti
10 Scientific revolutions and rationality - Kuhn, Lakatos and Feyerabend	Dr Luca Moretti
11 Galileo	Mr John Fox
12 Kepler and Brahe	Mr John Fox
13 Newton	Mr John Fox

**Here are the readings and tutorial questions for the 12 weeks of tutorials (tutorials start in the 2<sup>nd</sup> week of semester):**

Please note that the questions and readings for the first tutorial refer to the lectures from the week before. So the 1<sup>st</sup> tutorial in week two of semester concerns the content of the lectures in week one of semester.

**Tutorial # One – the week starting 9<sup>th</sup> March**

Lecture topic: Early Observations; the “two-sphere” universe; geometry

Reading: Your set text, Thomas Kuhn, *The Copernican Revolution*, chapter one, and Aristotle and Euclid from the *Astronomy and Philosophy 2009 Reader* (Source material and notes). Just approach the Aristotle and Euclid writings to get the flavour of their work.

Tutorial discussion topics: 1. What is the difference between what we mean by the poles and the equator and what the ancients meant? 2. How did (a) eclipses of the moon (b) sundial observations (c) different stars being seen in different places, provide evidence that the earth was round?

**Tutorial # Two – the week starting 16th March**

Lecture topic: Arguments; Aristotle's picture; the problem of the planets; Eudoxos

Reading: Thomas Kuhn *The Copernican Revolution*, Chapter 2, Kuhn chapter 3, Kuhn technical appendix sections 3 & 4.

Tutorial discussion topics: What are Aristotle's five elements? What does the theory explain about where things are and how they move? What are retrogressions? What would you actually see when a planet is retrogressing?

**Tutorial # Three - the week starting 23<sup>rd</sup> March (short exercise ONE due this week)**

Lecture topic: Difficulties; Alternatives (Pythagoreans, Atomists...); Ptolemy and epicycles

Reading: Kuhn chapter 4, *Astronomy and Philosophy 2009 Reader* (readings up to and including Ptolemy)

Tutorial discussion topics: In many ways our view of the world is more like the atomists than like Aristotle's. Should a reasonable astronomer of their day have preferred their view? State in your own words Ptolemy's argument that the earth is at the centre of the universe.

**Tutorial # Four – the week starting 30<sup>th</sup> March**

Lecture topic: More Ptolemy (equants, eccentrics...); Middle Ages: Buridan, Oresme

## *Astronomy and Philosophy, 2009, Subject Learning Guide*

Reading: Finish last week's readings

Tutorial discussion topics: What could Ptolemy's account of retrogression explain that Edoxos' could not and how? Would you have been persuaded by Oresme's examples that only relative motion can be observed?

### **Tutorial # Five – the week starting 6<sup>th</sup> April**

Lecture topic: Copernicus' theory

Reading: Kuhn pages 134-160.

Tutorial discussion topics: What are the differences and similarities between Copernicus and Ptolemy's theories?

### **Tutorial # Six – the week starting 20<sup>th</sup> April (short exercise TWO due this week)**

Lecture topic: The rationality of Copernicus' theory?

Reading: *Astronomy and Philosophy 2009 Reader* (Millman reading)

Tutorial discussion topics: Kuhn argues that the appeal of Copernicus' theory was aesthetic rather than pragmatic. Is there any alternative explanation for the appeal of Copernicus' theory?

### **Tutorial # Seven – the week starting 27<sup>th</sup> April**

Lecture topic: The Copernican revolution.

Reading: *Astronomy and Philosophy 2009 Reader* (Hanson reading)

Tutorial discussion topics: How did the revolution impact upon XVIth and XVIIth century astronomy?

### **Tutorial # Eight – the week starting 4<sup>th</sup> May (ESSAY due this week)**

Lecture topic: Scientific methodology & Inductivism

Reading: *Astronomy and Philosophy Reader* (Ladyman reading, excerpts from chs. 1 and 2)

Tutorial discussion topics: What do we mean by scientific methodology? What is inductivism? What are the limits of inductivism? Can inductivism explain the Copernican revolution?

### **Tutorial # Nine – the week starting 11<sup>th</sup> May (short exercise THREE due this week)**

Lecture topic: Popper's Falsificationism

Reading: *Astronomy and Philosophy 2009 Reader* (Ladyman reading, excerpts from ch. 3)

Tutorial discussion topics: Briefly explain Popper's conception of science. What is the difference between the context of discovery and the context of justification? What does it mean that the heliocentric theory and the geocentric theory were empirically underdetermined? Were they empirically underdetermined? Why would this be a problem for Falsificationism?

### **Tutorial # Ten – the week starting 18<sup>th</sup> May**

Lecture topic: Scientific revolutions and rationality - Kuhn, Lakatos and Feyerabend

Reading: *Astronomy and Philosophy 2009 Reader* (Lakatos reading)

Tutorial discussion topics: What is the difference between a scientific research program and a scientific theory? Why did the Copernican research program supersede the Ptolemaic research program according to Lakatos? In what case should we abandon a research program?

### **Tutorial # Eleven – the week starting 25<sup>th</sup> May**

Lecture topic: Galileo

Reading: Kuhn Chapter 6, *Astronomy and Philosophy 2009 Reader* (Galileo reading)

Tutorial discussion topics: Explain the "assault" Mars made on the Copernican system, in words and with diagrams. How (if at all) did each of Galileo's various telescopic discoveries support the Copernican system?

### **Tutorial # Twelve – the week starting 1<sup>st</sup> June (short exercise FOUR due this week)**

Lecture topic: Kepler and Brahe

Reading: *Astronomy and Philosophy 2009 Reader* (Kepler and Brahe readings), plus Hansen (already set for tutorial # 7).

Tutorial discussion topics: Can you explain Kepler's first two laws and illustrate them with diagrams. Was Brahe's system as good as Copernicus'?

**Set text:** The set text for this subject is Thomas Kuhn, *The Copernican Revolution*. We recommend that

you buy this text which is available from the La Trobe University bookshop. It will also be on Reserve at the Bundoora Library.

**Set Reader (source materials):** The Reader for this subject is available from the La Trobe University bookshop. It will also be on Reserve at the Bundoora Library.

**Electronic reserve:** some further reading is available by electronic reserve from the Bundoora library. If you search for materials under the subject code (PH11AAP) you will find a set of digitized readings.

## **Section 2: Survival Information**

### **Accessing the Learning Management System (LMS)**

LMS is a web-based means of accessing information for this course. It will include handouts, lecture summaries and essay questions. It will also have links, web pages and announcements.

For instruction on how to get started go to the LMS Guides available at <http://www.latrobe.edu.au/studentlmsinfo/> or email [studyhall@latrobe.edu.au](mailto:studyhall@latrobe.edu.au)

### **Assessment requirements and definitions**

Full details regarding submission and all other matters connected with essays are in the *Philosophy Program Student Guide*.

Your work will be assessed on the assumption that you have read the *Student Guide* accessed from <http://www.latrobe.edu.au/philosophy/resources Ug/index.html>. You can also download an assignment/essay cover sheet (statement of individual authorship) from this site. The Essay Question notices (which will be distributed in lectures and made available on LMS) will also contain detailed information about submission of work.

### **Assessment Criteria**

When assessing your work in philosophy your markers take into account the following criteria: evidence that you understand the issues being addressed; the quality of your argument; the structure of your essay/assignment; independence of thought; clarity; relevance of your discussion to the set question; your English expression; use of references and appropriate incorporation of a bibliography.

### **Late Penalties**

A late penalty of 2% of the available marks applies for each working day beyond the due date (either original or extended) up to but not exceeding ten working days. Work submitted more than ten working days after the due date (either original or extended) will not be accepted. Extensions will normally be granted to students who have medical or comparably serious reasons for seeking an extension, but not otherwise. The Subject Coordinator will normally consider applications for extension of time, and these will normally be sought prior to the due date; however, extensions may be granted retrospectively at the discretion of the Subject Coordinator, Program Coordinator or Head of School.

### **Rules about acknowledging your sources and avoiding plagiarism.**

Your signature on the cover sheet to be attached to assignments/essays involves a declaration that you have read the information on plagiarism in the *Philosophy Program Student Guide*. The Philosophy Program has a very strict policy on plagiarism, and penalties can be severe. IT IS YOUR RESPONSIBILITY TO BE FAMILIAR WITH THE STATEMENT OF THE PROGRAM'S REQUIREMENTS ON ASSIGNMENTS/ESSAYS. You should also consider participating in the LMS course 'Plagiarism' that has been developed by the University's Academic Development Unit. You will need to login in to LMS to access this. You can also use the online facilities provided by the Borchardt Library to assist you with matters such as referencing: <http://www.lib.latrobe.edu.au/libskills/>.

### **Special circumstance processes**

#### **Applying for Special Consideration**

If your work during the semester is seriously disrupted by circumstances such as illness or other serious problems, you may need to apply for special consideration. You will need to complete a Special Consideration form available at the Student Centre in the David Myers Building.

### **The Language and Academic Skills Unit**

We strongly encourage you to attend the HASU - Writing Better Essays workshops. Visit the website <http://www.latrobe.edu.au/humanities/supportunits/hasu.html#workshops>.

Your tutor may also consider that you are having difficulties with writing, which could be reduced by your consulting an adviser in HASU. Seeing an adviser is a valuable opportunity to improve your writing skills. If your tutor does give you this advice, you should promptly make an appointment to see the adviser and take your essay with you to the first meeting. The adviser you will see will be either Dr Kate Chanock, or one of her colleagues, in Humanities 3 Building, Room 414. Phone: 9479-2535. Email: [c.chanock@latrobe.edu.au](mailto:c.chanock@latrobe.edu.au)

If your first language is not English, you should consult an adviser in the ESL Unit, also on the 4th floor of the Humanities 3 Building, Rms 416-418, ph: 9479-2788. Email: [lasels@latrobe.edu.au](mailto:lasels@latrobe.edu.au). For more information go to <http://www.latrobe.edu.au/lasels/>

### **Equity and Access Unit**

The Unit's primary role is to promote full and equal participation of all students and staff at the University and to foster an environment free of discrimination and harassment. The Unit runs support services for Students with Disabilities and Additional Needs, Deaf Academic Services, Ngarn-gi Bagora Indigenous Centre and co-ordinates a number of programs to promote equal opportunity for undergraduate students. For more information on these and other support services go to <http://www.latrobe.edu.au/equity/>

### **Feedback and Quality Assurance processes**

In the final weeks of the semester you will be asked to complete a brief questionnaire about the subject, either in class or online. You may also be asked about your learning experience in connection with individual teachers. Your responses form an important part of the process of assessing the quality of the delivery of this subject and they are used to make improvements. For example, in the past we have used this information to develop those aspects of the subject that students have found most rewarding and we have modified the topics and readings to make them more responsive to students' interests. Please take the time to complete the questionnaire as we value your feedback.

### **Library Guide to Philosophy Research**

<http://latrobe.libguides.com/philosophy>

## **Astronomy and Philosophy 2009 — PHI1AAP and PHI2HPSA**

### **Short answer exercises**

There are FOUR short exercises to be handed in as part of your assessment for PHI1AAP and PHI2HPSA (See Subject Learning Guide, under Assessment).

Each exercise needs to be handed in to your tutor on the due date. No extensions can be granted except for *exceptional circumstances*. Extensions will normally require a medical certificate and can be granted by the lecturer, tutor or course coordinator.

Exercises must be typed or word-processed. There are computers and printing facilities in the computer hall (between Glenn and Menzies Colleges) if you need them. (If this requirement presents a significant problem for you, you should consult the coordinator.)

**Good standards of English expression and neat, clear presentation are required.**

Your exercises will also be used by your tutor to judge whether you should seek additional assistance in essay writing or English expression. If your exercises show poor English expression, your tutor may advise you or direct you to see an adviser in the Humanities and Social Sciences Academic Skills unit. (See Astronomy and Philosophy Subject Guide)

#### **Exercise One**

Due: the week beginning Monday March 23rd

Length: PHI1AAP students, 150-200 words.

PHI2HPSA students, 250 words.

Answer ONE of the following questions (all students):

(1) Consider the theory that the stars are fixed on a sphere that rotates daily. Mention at least three things we can observe with the naked eye that this theory, if true, would explain nicely; and make it clear how it would.

(2) Describe how the Greeks measured the circumference of the earth and the distance of the earth from the sun, and explain how despite sound geometry and method, they managed notably to underestimate this last distance.

#### **Exercise Two**

Due: the week beginning Monday 20<sup>th</sup> April

Length: PHI1AAP students, 150-200 words.

PHI2HPSA students, 250 words.

FOR PHI1AAP students, answer ONE of the following questions:

1. What are the main aspects of Copernicus' theory?
2. In what way does Copernicus' theory differ from Ptolemy's? Discuss.
3. Was Copernicus' a significantly better theory than Ptolemy's? Discuss.
4. Is the Copernican revolution the same as Copernicus' theory? Discuss.

FOR PHI2HPSA students, answer ONE of the following questions:

1. Why did Copernicus' theory initiate a scientific revolution?
2. Is Copernicus' theory rational? Discuss
3. Why does Kuhn claim that the success of Copernicus' theory was nothing more than a matter of taste?

### **Exercise Three**

Due: the week beginning Monday 11<sup>th</sup> May

Length: PHI1AAP students, 150-200 words.

PHI2HPSA students, 250 words.

Answer ONE of the following questions (all students):

1. Can the methodology called inductivism explain the Copernican revolution? Explain.
2. Do you think that Popper's falsificationism provides a realistic picture of what the scientific method is? Explain.
3. Can you outline what - to use Lakatos' language - is the Copernican research program?

### **Exercise Four**

Due: the week beginning Monday 1<sup>st</sup> June

Length: PHI1AAP students, 150-200 words.

PHI2HPSA students, 250 words.

Answer ONE of the following questions (all students):

1. Say why naked eye observations both of Mars and of Venus provided severe difficulties for the Copernican view. How did Galileo's work answer these difficulties?
2. Show how Newton's "rules of reasoning" and his "phenomena" together provided his basis for arguing for the law of universal gravitation.