

# Physics / Geology 156: Scientific Revolutions

Fall 2012

## SYLLABUS

<b>CLASS TIME</b>	TuTh 2:00-3:50pm, Willamette 110
<b>INSTRUCTORS AND CONTACT INFORMATION</b>	<b>Professor Samantha Hopkins</b> Office: 101F Chapman and 224 Volcanology Office hours: T 10am-12pm in Chapman, W 1:30-3:30pm in Volcanology Email: <a href="mailto:shopkins@uoregon.edu">shopkins@uoregon.edu</a> <b>Professor Raghuvēer Parthasarathy (Par-tha-sa-ra-thē)</b> Office: 362 Willamette Hall Office hours: Wed. 1:00-2:30pm, Th. 12.30-2:00pm Email: <a href="mailto:raghu@uoregon.edu">raghu@uoregon.edu</a>
<b>COURSE DESCRIPTION</b>	This course will examine scientific revolutions that have dramatically altered the ways in which we view the world. Our discussions will explore major concepts (including quantum mechanics, evolution, plate tectonics, and chaos theory) central to a diverse group of scientific disciplines. Discussions will focus on understanding what these revolutions were, and what views they superseded. Students will gain an understanding of how science generates questions and defines the questions it investigates, while considering scientific revolutions in their respective historical contexts. We will also explore the technological and societal consequences of these revolutions, in order to understand the role of scientific discoveries in shaping our lives.
<b>TEACHING ASSISTANTS</b>	<b>Ashleigh Boyd, GTF; Undergraduate Scholars Daniel Mulkey, Brianna McHorse</b> The teaching assistants for this course are “fellows” in the University of Oregon’s Science Literacy Program (SLP), a new initiative funded by the Howard Hughes Medical Institute. Spanning several departments, SLP fellows will hold office hours and also help orchestrate in-class activities. One of their main tasks is to serve as resources, for example helping you understand a wide variety of scientific content fairly quickly. Make use of them!
<b>LEARNING OBJECTIVES</b>	<ol style="list-style-type: none"><li>1. How does science work? We seek to gain an understanding of the scientific process by examining several “scientific revolutions”</li><li>2. We will learn about the importance of several major ideas (evolution, plate tectonics, chaos theory, and quantum mechanics) to history, society, and modern science.</li></ol>
<b>ASSIGNMENTS</b>	<i>Readings and reading questions</i> – For most topics, there will be one or more readings (see below) and a small set of questions related to that reading, to be answered by each student on-line before class. <i>Homework</i> – There will be weekly homework assigned that will provide practice in using the ideas and concepts explored in class.
<b>BLACKBOARD</b>	We will be using Blackboard in this course to distribute course materials, and also for on-line assignments. URL: <a href="https://blackboard.uoregon.edu/">https://blackboard.uoregon.edu/</a> Please pay close attention to formatting requirements for submitting on-line answers –

	Blackboard can be infuriatingly inflexible.
<b>EMAIL</b>	<b>Email:</b> You can certainly ask questions by email. Note, however, that we rarely respond to emails that begin “Hey...” or are otherwise poorly constructed.
<b>TEXTBOOK</b>	We will read parts of several books as well as various articles. The following books are required: <ul style="list-style-type: none"> <li>• James Gleick, <i>Chaos: Making a New Science</i> (Penguin – any edition is fine)</li> <li>• John Gribbin, <i>In Search of Schrodinger’s Cat</i> (Bantam, 1984)</li> </ul>
<b>READINGS</b>	Additional readings will be provided by the instructors on the course Blackboard site ( <a href="https://blackboard.uoregon.edu/">https://blackboard.uoregon.edu/</a> ).
<b>CLICKERS</b>	Each student is required to have a “clicker.” Clickers are available in the UO bookstore; if you know someone <i>not</i> enrolled in this course, borrowing their clicker for this class will work fine. These “personal response systems” allow real-time assessment of student understanding of concepts, and will be used for a variety of in-class activities. There is a participation grade, based on in-class clicker questions. These are scored by participation <i>only</i> , not the accuracy of the response <i>Absences or forgotten clickers:</i> Missed points cannot be made up. However, the clicker scores will be scaled so that a 90% participation score is “perfect” – i.e. allowing 10% of the points to be missed without penalty.
<b>QUIZZES AND EXAMS</b>	There will be four quizzes, each covering one of the four main topics of the course (see “Calendar,” below). The quizzes will contain multiple choice and short answer questions, and will span roughly half a class period each. There will be a cumulative final exam, also with both multiple choice and short answer questions.
<b>GRADING</b>	In general, vibrant class participation enhances all students’ learning experiences – one of the motivations for “clicker” usage. However, we consider it overly paternalistic to require attendance. Therefore there will be two possible weightings of the various grade components: <ul style="list-style-type: none"> <li>• <i>Participation</i> (see “clickers”): P</li> <li>• <i>Pre-class Reading Questions</i> (see “Assignments”): RQ</li> <li>• <i>Homework Assignments</i>: HW</li> <li>• <i>Total Quiz Grade – each of the four quizzes is weighted equally</i>: Q</li> <li>• <i>Final Exam (1pm Monday Dec. 3 / 110 Willamette)</i>.</li> </ul> Grading option 1: HW / RQ / P / Q / Final = 25/10/10/35/20 % Grading option 2: HW / RQ / P / Q / Final = 25/10/ 0 /40/25 % We’ll grade each student using both options, keeping the higher overall score. <b>Final Grade:</b> A=88-100%; B=76-87.9%; C=64-75.9%; D=56-63.9%; F<56%.
<b>ABSENCES</b>	If there is a serious (e.g. involving illness) and well-documented (e.g. with a doctor’s note) reason for missing quizzes, the final exam score will count extra, in place of the missed tests.
<b>CALENDAR</b>	<i>Weeks 1-2:</i> Evolution – Natural selection, Darwin and Wallace; Age of the earth; Inheritance, genetics, and sources of variation; evolution of development <i>Week 3-4:</i> Quantum Mechanics – Classical physics; the wave nature of light; early Quantum Mechanics and the wave nature of particles; measurement, uncertainty,

	<p>philosophy and meaning in Quantum Mechanics. Also: technological applications and current research.</p> <p><i>Weeks 5-6:</i> Plate Tectonics – uniformitarianism and catastrophism; structure of earth; continental drift; earth’s magnetic field; subduction, mid-ocean ridges, mountains, earthquakes, and volcanoes; unifying processes; resistance to changing ideas and how ideas spread</p> <p><i>Weeks 7-9 (Week 8 is short, due to Thanksgiving):</i> Chaos Theory – Determinism and classical physics – history and philosophy; pendulums and oscillatory motion; the logistic map and population dynamics; fractals and power-law scaling; turbulence; the scientific method, interdisciplinary science, and the history of chaos</p> <p><i>Week 10:</i> Kuhn’s <u>Structure of Scientific Revolutions</u>, Failed scientific revolutions</p>
<p><b>LAPTOPS IN CLASS</b></p> <p><u>The use of laptop computers in class is not allowed.</u> Why? Several studies, plus past experience, show that students using laptops in class spend a great deal of time on non-class-related activities (surfing the web, playing games, ...) and that these distractions negatively impact both learning and grades. This alone isn’t a reason to ban laptops – you’re responsible for your own performance in class. <i>In addition</i>, however, studies have shown that non-class-related laptop use distracts and impacts the learning of <i>other students nearby</i>. (E.g. Fried, C. B. <i>Computers &amp; Education</i> <b>50</b>, 906-914 (2008).) Plus, <i>students</i> have complained to us about the environment created by their classmates laptop use.</p> <p>Taking notes by hand, by the way, is more effective in cementing concepts in your mind. (Note, by the way, that lecture slides are posted on-line, so you don’t have to frantically transcribe everything anyway.)</p> <p>In summary, laptops are not allowed in class. The only exceptions will be for people with documented medical needs; please see me if this is the case.</p>	
<p><b>EXPECTED WORKLOAD</b></p>	<p>Students should expect to spend approximately 3 hours per week on reading assignments, as well as another 5-10 hours per week on homework assignments and reading questions.</p> <p>Homework, assigned weekly, will consist of exercises that assess and develop students’ understanding of scientific concepts covered in class and in the readings, and also mathematical exercises and analyses of graphs or other forms of scientific visualization.</p> <p>Reading questions will assess specific topics encountered in the readings, ranging from simple facts to deeper scientific concepts.</p>
<p><b>NECESSARY CAVEATS</b></p>	<p>Students are expected to abide by university policies on academic honesty, avoiding plagiarism, fabrication, cheating, and academic misconduct. The Student Conduct Code (<a href="http://conduct.uoregon.edu/">http://conduct.uoregon.edu/</a>) provides definitions of these terms and explanations of the university policy on the subject. The UO Library also provides a guide to avoiding plagiarism (<a href="http://libweb.uoregon.edu/guides/plagiarism/students/">http://libweb.uoregon.edu/guides/plagiarism/students/</a>). You are responsible for understanding these regulations and abiding by them. Students should be particularly careful to avoid plagiarism and excessive collaboration in writing up out-of-class assignments, and in working on projects and exams. Academic dishonesty will be dealt with severely, as it is disrespectful to your fellow students and your instructor, as well as being against both university regulations and state</p>

	laws.
<b>STUDENTS WITH DISABILITIES</b>	If there are aspects of the instruction or design of this course that result in barriers to your inclusion, please notify Profs. Hopkins and Parthasarathy as soon as possible. You are also welcome to contact Disability Services in 164 Oregon Hall, 346-1155.
<b>SUCCEEDING IN THIS COURSE</b>	<p><b>Plan ahead and start early!</b> The reading assignments are a vital part of this course, and it is important to start reading them early not only to understand the subject matter but to be able to articulate what you <i>don't</i> understand – in class lectures and discussions will build on your reading experiences. Note that the reading assignments must be done <b>before</b> the days at which their topics are discussed in lecture. In general, it will be crucial to keep up with the course and not fall behind; later topics will build on earlier ones.</p> <p><b>Make use of available resources.</b> If you have questions about lectures, assignments, readings, or other matters, please visit Profs. Hopkins and Parthasarathy during office hours, or communicate by phone or email. Individual appointments can certainly be arranged to accommodate schedule conflicts with the regular office hours.</p> <p>The University's Academic Learning Services (ALS) center provides a variety of workshops, individual consultations, writing assistance labs, and more to assist UO students. For more information please see <a href="http://als.uoregon.edu">als.uoregon.edu</a>, or call (541) 346 3226.</p>