Astro 100 MW

Daytime

The Solar System

IUI Physics Department **Spring 2024**

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GENERAL INFORMATION

Description: An introductory survey of the eight planets, sun, asteroids, and comets found in our solar system. Newton's and Kepler's laws describing the motion of the planets. Plus interesting information about space.

Profiles of Learning: In this course, we encounter the four IUI Profiles of Learning (POL).

The two primary POLs for astronomy are

Problem Solvers: Work individually and with others to collect, analyze, evaluate, and synthesize information to implement innovative solutions to challenging local and global problems.

Communicators: Convey ideas effectively and ethically in oral, written, and visual forms across multiple settings, using face-to-face and mediated channels.

The remaining POLs are briefly encountered in introductory astronomy

Innovators: Build on experiences and disciplinary expertise to approach new situations and circumstances in original ways, are willing to take risks with ideas, and pose solutions.

Community Contributors: Are active and valued on the campus and in communities locally and globally. They are personally responsible, self-aware, civically engaged, and look outward to understand the needs of society and their environment.

Course Learning Objectives: This course is a General Education Course in the Life and Physical Sciences domain for colleges and universities in Indiana. Throughout the semester we address, multiple times, the six Learning Objectives of Astronomy A100:

(i) **How astronomical explanations are formulated, tested, and modified or validated.**

(ii) **Differences between scientific and non-scientific evidence and explanations.**

(iii) **Foundational knowledge and astronomical-specific concepts to address issues or solve problems.**

(iv) **Observational, quantitative, and technological methods to gather data and generate evidence-based conclusions.**

(v) **How theories describe, explain, and predict natural phenomena.**

(vi) **How to locate sources of astronomical evidence to construct arguments.**

How Learning Outcomes are Assessed: There will be 8 quizzes, given approximately each week, that cover the material lectured during the previous week(s). There will be two (75-minute long) exams administered during the semester. There will be a comprehensive final exam (2 hours) administered during finals' week.

Profiles of Learning Integration With Learning Outcomes: Listed below are: (1) *Learning Objectives (Outcomes)* and examples of how they (2) Integrate with the Profiles of Learning (POL).

(i) *How astronomical explanations are formulated, tested, and modified or validated:* As *Problem Solvers* we examine the stellar theory of Kelvin and Helmholtz and from the analysis we show it cannot be correct. And as good *Communicators* we learn how to explain to the layperson, the requirement for a modern theory of stellar evolution based on nuclear physics that incorporates one very important element from quantum theory.

(ii) *Differences between scientific and non-scientific evidence and explanations:* As *Communicators*, we revisit the struggles of Copernicus as he challenged the then current religious dogma in addressing the biases of an Earth-centered universe. We discuss the important contribution of Galileo, explaining the origin of all sun-lit phases of Venus.

(iii) *Foundational knowledge and astronomical-specific concepts to address issues or solve problems:* As *Problem Solvers* we first review the theory of the evolution of the terrestrial atmospheres: Earth, Venus, and Mars and how we can use that to address the global warming on Earth. We present current data on Earth's greenhouse gases and show that one of them, CO_2, has risen significantly due to industrial processes.

(iv) *Observational, quantitative, and technological methods to gather data and generate evidence-based conclusions:* Astronomers are *Innovators*, we need accurate geological dating of Mars' and Moon's surfaces to support the development of general stellar evolution theories. Because of recent innovations, we have leveraged advances in micro-electronics to build advanced soil-sampling devices; new data from the samples (Mars) have aided in the refinement of stellar evolution theory.

(v) *How theories describe, explain, and predict natural phenomena:* As *Problem Solvers* we review Big Bang Theory, and the origin of hydrogen, helium, and lithium and their observed quantities in our solar system. We discuss the theory of the abundances of each and present the measured/observed abundances data. An important goal in astronomy is to explain the origin of matter in our universe. We discuss how the Big Bang Theory gives us the observed concentrations of virtually every element found in the Periodic Table.

(vi) *How to locate sources of astronomical evidence to construct arguments:* Astronomers are *Communicators*, as a student in this course, you will be required to explain/show why the motion of Mercury around the sun was an important first test of Einstein's Theory of General Relativity (GR). You will describe the shortcomings of Newton's Law of Gravity and contrast it with the many advantages of GR. But you will also explain why we have not completely abandoned Newton's Law of Gravity, *i.e,* we don't use GR to explain a block sliding down an incline.

Text: *THE COSMIC PERSPECTIVE* **The Solar System** by Bennett, *et. al.*, any recent edition, Pearson Publishing. NOTE: This text is quite extensive and in most cases provides too much detail. In the end, you are responsible for knowing and understanding my lectures notes. You should use the text to supplement the lecture notes (*i.e,* "fill in the details") – the exams and quizzes are based on the lecture notes.

Web: `http://woodahl.physics.iupui.edu/Astro100/` Mark this website in your browser. At the web site you will find: Syllabus (which you are reading now) in PDF, Master Schedule in PDF, and announcements.

Contact: You should try to use your official "`name@iu.edu`" email when contacting me. Others may be rejected by the UITS junk email filters.

Lecture: Meet from Noon - 1:15 on Monday and Wednesday in ET 202. This course is presented in the traditional format consisting of formal lectures in front of students. During the lectures I will cover, in detail the important concepts. The tests and quizzes are based on the lecture material. I urge you to collaborate with a classmate in sharing notes if one of you misses a lecture. NOTE: Copies of lecture notes will not be provided to students.

Quizzes: Quizzes given approximately once a week, will be over the material since the previous quiz (or exam). There will be a total of eight quizzes. No quizzes are dropped and there are no makeups on any quizzes **under any circumstances**. Format for the quizzes is four multiple choice questions (with four possible answers). Keep your quizzes for exam review.

Exams: There will be two exams (one-hour in length) and a comprehensive final exam, as listed in the schedule. Exams are worth 100 points (in overall course points). There are no makeups on any exams! Exam study guides will be posted about 1 week in advance. Do not miss an exam – you will receive a zero for that exam (there are no exceptions). Furthermore, no exams will be given early – if you have a an outside unmitigated conflict with an exam date/time, drop the course now. Format for the exams is generally seventy (± 10) multiple choice questions (with four possible answers) and possibly (not always) 2 partial-credit computational (or short answer) problems. During the exams, it is essential to use a pencil (No. 2 or HB) for the op-scan sheets. **Failure to use pencil during the exams results in a zero.** Exam scores and quiz scores will be posted in Canvas approximately a week (after each exam).

Withdrawal: If it is necessary for you to drop this course, please do so officially, filling out all the necessary paperwork. Otherwise per University policy you will receive an F on your transcript.

Telescopes: The department has several Dobsonian telescopes (altazimuth-mounted Newtonian telescope first designed by Dobson in 1965) for student use. They can be used to view some features of the moon (e.g. Lunar Maria). They may be borrowed for a few weeks at a time. Please check with me for details.

Weighting: The final letter grade will be determined from your cumulative point total based on the following weights:

Quizzes	80
Exam I	100
Exam II	100
Final Exam	100

Grades: The following are the *guaranteed* cuts for the letter grades based upon the 380 point total. In most cases the cuts will be lower than that advertised below:

A−	≥ 340
B−	≥ 300
C−	≥ 260