

SPRINGFIELD COLLEGE IN ILLINOIS

New Horizons Session E, 2006
Weaver Hall W-37
M 6:00 – 10:00 PM

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The Universe: Stars, Planets, and Our Solar System (PHY 206)

I. Course Description

The Universe: Stars, Planets and Our Solar System (4 credits) is a course designed to emphasize the constructs of nearby space phenomena by use of lectures and lab. Areas of study include an overview of ancient and modern astronomy; becoming familiar with the celestial sphere; developing observational techniques for night time viewing; the concepts of space, time, and gravity; a thorough study of each planet in our solar system; plus comets and asteroids; and our own Milky Way Galaxy. Prerequisite: one year of high school algebra or equivalent. (Three lecture hours and one three-hour laboratory weekly). IAI P1 906L.

II. Textbook and Materials

John D. Fix, *Astronomy: Journey to the Cosmic Frontier* (4th edition)

III. Mission Statement

The mission of Springfield College in Illinois is to provide students the best liberal arts education in the Ursuline tradition of a nurturing faith-based environment. We prepare students for a life of learning, leadership and service in a diverse world.

IV. Goals, Objectives, and Outcomes

- A. *Goals*: The student should complete this course with
- comprehension of the physical principles central to understanding the physical universe
 - the ability to apply those principles to understand complex natural phenomena
 - the ability to formulate and test hypotheses concerning physical phenomena
- B. *Objectives*. The following Common Student Learning Objectives (CSLOs) adopted Dec. 9, 2004, are addressed:
- Content Knowledge (Lifelong Learning) CK-1. Know and apply the central concepts of the subject matter.
 - Content Knowledge (Lifelong Learning) CK-3. Use technology to enhance learning.
 - Problem-Solving Skills (Lifelong Learning and Leadership) PS-1. Use inquiry and collaboration to solve problems.
 - Social Responsibility (Service and Leadership) SR-2. Make ethical and informed decisions.
- C. *Course Based Student Learning Objectives*. Upon completion of the course, students will be able to demonstrate their mastery of the following learning outcomes, addressing the following CLSOs (in parentheses):
- CBSLO-1. To describe the fundamental physical principles, including those governing principles motion, force, energy, thermal phenomena, and radiation, which are important for our understanding of astronomical phenomena (CK-1)
 - CBSLO-2. To apply knowledge of physical principles to understand the structure, evolution, and behavior of stars and the structure and evolution of planets, asteroids, comets, and moons (CK-1)
 - CBSLO-3. To predict, both qualitatively and quantitatively, the behavior of astronomical systems such as planets under a range of conditions (CK-1)
 - CBSLO-4. To use technology to experimentally investigate physical phenomena (CK-3)
 - CBSLO-5. To understand and internalize the need for treating others with respect (SR-2)

V. **Teaching Methods.** Lecture and classroom discussion, in-class laboratory exercises, homework assignments, and computer simulations.

VI. **Course Requirements**

A. *Attendance Policy:* Attendance is mandatory. Unexcused absence from a class session will result in a 5% reduction (half a letter grade) in a student's course grade; subsequent absences will result in a further 5% reduction per missed class. Attendance will be taken at each class; for the purposes of grading, a student will be considered absent if he or she is not present when attendance is taken, or if he or she leaves class after attendance is taken. Missed tests must be made up by the next scheduled class period; missed labs cannot be made up, nor will a student who has missed a lab receive any credit for a report on that lab. (CBSLO-5).

B. *Reading Assignments:* The following portions of the text should be read before class on the week indicated:

- Week 1 – Chapter 1 (CBSLO-1)
- Week 2 – Chapters 2 and 3 (CBSLO-1)
- Week 3 – Chapters 5 and 7 (CBSLO-1)
- Week 4 – Chapters 8, and 9 (CBSLO-2)
- Week 5 – Chapters 10 and 11 (CBSLO-2)
- Week 6 – Chapters 12 and 13 (CBSLO-2)
- Week 7 – Chapters 14 and 15 (CBSLO-2)
- Week 8 – Chapter 18 (CBSLO-2)

D. *Written Assignments:* Answers to the following Conceptual Questions (CQ), Problems (P), Figure-Based Questions (FBQ), and Figure- and Table-Based Questions (FTBQ) are due at the class session of the week indicated:

- Week 1: Chapter 1: CQ 3, 4; FBQ 1, 2, 3 (CBSLO-1, 3)
- Week 2: Chapter 2: CQ 2, 4, 5, 11; FBQ 1, 2, 3 (CBSLO-1, 3)
- Week 3: Chapter 3: CQ 5; FBQ 1
- Chapter 4: CQ 2, 3; P 2, 3, 9; 12, 13; FBQ 2 (CBSLO-1, 3)
- Week 4: Chapter 5: CQ 3, 8; P 2, 7
- Chapter 7: CQ 2, 3, 5, 6; P 2, 10, 18; FBQ 2, 4, 6 (CBSLO-1, 2, 3)
- Week 5: Chapter 8: CQ 2, 3, 4, 5; P 2, 5, 6, 7; FBQ 1, 2 (CBSLO-2, 3)
- Week 6: Chapter 9: CQ 3, 6, 8
- Chapter 10: CQ 1, 6, 9
- Chapter 11: CQ 4, 9, 14; FTBQ 1 (CBSLO-2, 3)
- Week 7: Chapter 12: CQ 1, 10, 15; P 1; FBQ 2, 3
- Chapter 13: CQ 5, 12 (CBSLO-2, 3)
- Week 8: Chapter 14: CQ 7, 9, 10, 15
- Chapter 15: CQ 4, 5, 21 (CBSLO-2, 3)
- Term paper (CBSLO-2, 4)

D. *Plagiarism:* Plagiarism is defined as follows: "The deliberate and knowing presentation of another person's original ideas or creative expressions as one's own. Generally, plagiarism is immoral but not illegal. If the expression's creator gives unrestricted permission for its use and the user claims the expression as original, the user commits plagiarism but does not violate copyright laws. If the original expression is copied without permission, the plagiarist may violate copyright laws, even if credit goes to the creator. And if the plagiarism results in material gain, it may be deemed a passing-off activity that violates the Lanham Act." Black's Law Dictionary, 8th ed. (2004), p. 1187. Also useful to establish guidelines for delineating plagiarism is Diana Hacker's definition: "Three different acts are considered plagiarism: (1) failing to cite quotations and borrowed ideas, (2) failing to enclose borrowed language in quotation marks, and (3) failing to put summaries and paraphrases in your own words." (A Writer's Reference, by Diana Hacker, Bedford St. Martin's Press, 2003, page 331.

Some instances of plagiarism may, in fact, be violations of copyright law and subject to prosecution. The SCI Student Handbook lists plagiarism as a serious breach of conduct standards and will result in disciplinary action.

E. *Cell Phones:* Cell phones must be turned off during class sessions (CBSLO-5).

F. *Food and Beverages:* No food or beverages are allowed in the classroom at any time. There are no exceptions to this policy. Failure to comply will result in a loss of class points (CBSLO-5).

VI. Means of Evaluation of Outcomes

Students will be given points for all work collected and graded including tests, quizzes, homework, labs, and a term paper. The in-class tests are worth 20% of the course grade (10% per test); the homework for the semester, labs for the semester, and the term paper are each worth 20% of the course grade, and the final exam is worth 20% of the total grade. All of these points will accumulate into a “running total” that may be adjusted to count as “total points” from which percentages are calculated.

A = 90 – 100%

B = 80 – 90%

C = 70 – 80%

D = 60 – 70%

A student whose grade is *exactly* on the border between two letter grades will be given the higher of the two grades (e.g., a student with a grade percentage of 90.0% has earned an A, not a B; a student with a grade percentage of 89.9%, on the other hand, has earned a B).

In-class tests	200
Final Exam	200
Term Paper	200
Homework	200
<u>Labs</u>	<u>200</u>
Total	1000

Absence from class will result in a reduction of 50 points per unexcused absence. Your total number of course points will be converted into a letter grade on the following scale:

<u>Course Points earned</u>	<u>Grade</u>
900 – 1000	A
800 – 899	B
700 – 799	C
600 – 699	D
Below 600	E

VII. Topical Course Outline

NOTE: Some laboratory exercises will be observational in nature. As the feasibility of an observational lab is dependent on weather, the following lab schedule is tentative.

8/21 Week 1

Introduction to naked-eye astronomy; the changing night sky; the celestial sphere; angular measurement; the horizon system; circumpolar stars. Daily motion in the sky; the apparent motion of the Sun; seasons; time (apparent solar time, mean solar time, time zones, sidereal time, tropical year, leap year); phases of the Moon; motion of the Moon; motion of the planets (prograde and retrograde motion, synodic period. (CBSLO-1) **Laboratory:** Simulated night sky (CBSLO-4)

8/28 Week 2

Ancient Greek astronomy to Ptolemy; critical analysis of the Ptolemaic model; Copernicus; critical analysis of the Copernican model; Brahe, Kepler, Galileo (CBSLO-1). **Laboratory:** Simulated night sky (CBSLO-4)

HOMEWORK DUE: Ch. 2 CQ 2, 4, 5, 11; FBQ 1, 2, 3

9/04 Week 3

Isaac Newton: three laws of motion, law of gravity; application of Newtonian mechanics on Earth; application of Newtonian mechanics to astronomy: orbits, Kepler’s laws revisited, orbital speed, escape speed, tides); electromagnetic waves; radioactivity; chemical abundances in the solar system (CBSLO-1) **Laboratory:** The Galilean moons (CBSLO-4)

HOMEWORK DUE: Ch 3 CQ 5; FBQ 1; Ch 4 CQ 2, 3; P 2, 3, 9, 12, 13; FBQ 2

9/11 Week 4

The Earth: rotation and revolution; evidence for the earth’s rotation (Foucault pendulum, “centrifugal force” and the Coriolis effect); evidence for the Earth’s revolution (aberration of starlight, stellar parallax); age of the Earth; minerals and rocks; oceans and continents; plate

tectonics; the interior structure of the Earth; the dynamo effect and terrestrial magnetism; the Earth's atmosphere (composition, structure, greenhouse effect, anthropogenic changes); evolution of the Earth (CBSLO-2) **Laboratory:** Radioactive dating of rocks (CBSLO-4)

TEST 1

HOMEWORK DUE: Ch 5 CQ 3, 8; P 2, 7; Ch 7 CQ 2, 3, 5, 6; P 2, 10, 18; FBQ 2, 4, 6

9/18 Week 5

The Moon (motions, surface, maria and highlands, craters, chemical composition, cratering rates and age determinations, evidence of large impacts, origin of the Moon); Mercury (orbit, rotation, surface features, structure, large impacts); Venus (rotation, surface features, structure); Mars (atmosphere, surface features, volcanism, cratering rates, evolution of Mars: liquid water? Life?) (CBSLO-2) **Laboratory:** Telescopic observation of the Moon and identification of surface features (CBSLO-4)

HOMEWORK DUE: Ch 8 CQ 2, 3, 4, 5; P 2, 5, 6, 7; FBQ 1, 2

9/25 Week 6

Comparison of Jupiter and Saturn; basic properties of Jupiter and Saturn (size, mass, density, orbital distances, orbital periods); atmospheric structure of Jupiter and Saturn; interior structure of Jupiter and Saturn; internal heat sources in Jupiter and Saturn; magnetic fields of Jupiter and Saturn; rings (nature of the rings, the Roche limit, size and composition of ring constituents); discovery of the outer planets Uranus, Neptune, and Pluto; comparison of Uranus and Neptune; atmospheres of Uranus and Neptune; internal structure of Uranus and Neptune; Magnetic fields and magnetospheres of Uranus and Neptune; rings around Uranus and Neptune; an explanation for differences between Uranus and Neptune (CBSLO-2) **Laboratory:** telescopic observations of the giant planets (CBSLO-4)

TEST 2

HOMEWORK DUE: Ch 9 CQ 3, 6, 8; Ch 10 CQ 1, 6, 9; Ch 11 CQ 4, 9, 14, Figure- and Table-Based Question 1

10/2 Week 7

The Galilean moons; small and medium-sized icy bodies (Titan and other satellites of Saturn, the major satellites of Uranus, Triton, Pluto, Charon, Kuiper Belt objects, comets: size, mass, density, composition, rotation, orbital motion); searches for additional planets in the Solar system; small rocky bodies (Phobos, Deimos, the asteroids, meteoroids, meteor showers) (CBSLO-2) **Laboratory:** The changing night sky (CBSLO-4)

HOMEWORK DUE: Ch 12 CQ 1, 10, 15; P 1; FBQ 2, 3; Ch 13 CQ 5, 12

10/9 Week 8

Properties of the Sun; internal structure of the Sun; the power source for the Sun (historical proposed explanations, nuclear reactions, energy transport); the photosphere; the chromosphere; the corona.; an approach to an understanding of the formation of the Solar system; clues from stars; features of the Solar system that require explanation; observations of star-forming regions; protostars; disks around protostars and young stars; tidal and nebular hypotheses for the formation of the solar system; critical analyses of hypotheses; implications of hypotheses; observations of extrasolar planetary systems. **FINAL EXAM**

HOMEWORK DUE at Final Exam: Ch 14 CQ 7, 9, 10, 15; Ch 15 CQ 4, 5, 21

IX. Americans with Disabilities Act (ADA)

Springfield College in Illinois provides individuals with disabilities reasonable accommodations to participate in educational programs, activities, and services. Students with disabilities requiring accommodations to participate in college-sponsored programs, activities, and services or to meet course requirements should contact the Director of the Resource Center as early as possible.

X. Assessment: Classroom Assessment Techniques

Goals, objectives, and learning outcomes that will be assessed in the class are stated in this syllabus. The instructor will use pre/post-testing and a three-question survey in order to provide continuous improvement of instruction. Students are required to take part in all assessment measures.

XI. **IAI statement**

Physics 206 has been approved by the Illinois Articulation Initiative as meeting the criteria stipulated for P1 906L Examines astronomical phenomena and concepts, including the solar system, stars and galaxies, planetary motions, atoms and radiation and the origin and evolution of the universe.

HOMEWORK DUE: Ch. 1 Conceptual Questions (CQ) 3, 4; Figure-Based Questions (FBQ) 1, 2, 3