Syllabus
PHY1033C HIS 3931 IDH 3931
Discovering Physics:
The Universe and Humanity's Place In It.
Fall 2016

Instructor:

Peter Hirschfeld, NPB 2156, Office hours M4,T4,W5
Professor of Physics with interests in theory of superconductivity and matter at low temperatures

Reading Materials:
1. Frederick Gregory, *Natural Science in Western Hist*ory, Cengage, 2008, selections (required text).
2. Course pack at Target Copy (required)
3. Websites as indicated in the syllabus
4. Steven Weinberg, To Explain the World (recommended)
6. Physics for Poets, Robert March, McGraw-Hill, 1996 (recommended).
7. Cosmos, Carl Sagan, 1985 (recommended).

Course Description:
This course will explore humans' view of terrestrial and celestial phenomena from ancient to modern times, and in parallel offer basic explanations of how science views these phenomena today. Topics include the solar system and how various civilizations and eras have conceived of its structure, light and relativity, and modern concepts of cosmology.

Course objectives: Through an interdisciplinary approach we will enable non-scientists to appreciate the modern scientific paradigm while learning how this paradigm was actually developed. Rather than present modern ideas about time, space and the solar system as facts to be memorized and regurgitated, the course will expose students to the convoluted path by which these ideas arose, including the many mistakes made by philosophers and scientists along the way. By the end, students will not only understand more about how the universe works, but will have acquired a framework to think about technological aspects of the world around them, as well as the realization that science is an organic, evolving enterprise rather than a static set of "correct answers".

Prerequisites: None

Course objectives will be accomplished through the following required work:
Required Work: Course requirements will include readings in Gregory, *Natural Science in Western History*, readings in a course pack, and websites as indicated in the syllabus. There will also be occasional problem sets based on the material and a series of simple illustrative in-class laboratory experiments.

Homework:

There will be 10 weekly homework assignments posted on the web on Tuesdays. Solutions will be posted after the due date, which will be Tuesday at 5pm of following week. Late homework is not accepted. Please turn in all homework assignments in class or to Prof. Hirschfeld's faculty mailbox near the Physics Department main office. Each homework is worth 10 points. The two lowest homework scores will be dropped and the two highest scores doubled; the remaining sum will be scaled to a possible 100 points for this component of the course.

Labs:

There are 10 laboratories, each worth 10 points. The lowest two lab scores will be dropped and the two highest scores doubled; the remaining sum will be scaled to a possible 100 points for this component of the course.

Tests:

There will be one midterm examination and one final exam. You must bring writing instruments, a calculator and a student registration card with a photo for both exams. All necessary paper will be provided.

In-class midterm: Oct 13 , NPB 1002, in class
Final: Dec. 15, 10:00 a.m. - 12:00 p.m., NPB 1002

Grading:

Homework: 30%, Labs: 25%, Midterm: 20%, Final: 25%

There will be *no* "extra credit" under any circumstances unless specified explicitly in the assignment. Letter grades may be assigned according to a "curved" distribution: > . However the following scores will guarantee the following grades: 90--A, > 87--A-; >84--B+, > 80--B,>77--B- >74—C+, >70--C, >67—C-, >64—D+,>60--D.

Students are responsible for all material covered in the textbook, lab, and in lecture, including any announcements made or special handouts distributed in lab or lecture. If you must be absent during a given lab or lecture, check with a friend to make sure you know what was covered.

Makeup and late policy: a makeup will be available for the midterm exam in the case of a medical or other emergency with presentation of an *officially documented* excuse. Because the drop policy for homeworks and labs is very generous, makeups will not be available and late assignments will not be accepted.

Required materials lab book, calculator, HITT remote clicker. Remotes will be used to ask quick-response questions in class, at least 1/day, counting towards 2% *extra credit* on final grade.

Remark on UF requirements:

If you are registered for PHY1033C, you automatically satisfy GenEd physical science and laboratory requirement by taking this course. If you are registered for HIS3931 or IDH3931 you must obtain this credit by petition. It should be granted automatically.

Schedule:

Discovering Physics: The Universe and Humanity's Place In It

Week 1	How ancient humans viewed the universe
Aug. 23	Introduction to course
Aug. 25	From Egypt and Babylonia to the Greek miracle
Reading	Gregory, Ch. 1 Preface to Weinberg, To Explain the World, online at amazon

	http://www.amazon.com/To-Explain-World-Discovery-Science/dp/0062346652#reader_0062346652
Week 2	The Greeks make sense of motion on earth and in the heavens
Aug. 30	Aristotle's physics
Aug. 30 no lab	
Sept. 1	Rationality in ancient and modern physics
Reading	Gregory, Chapter 1 Ptolemy's Almagest, Section 3-7, http://bertie.ccsu.edu/naturesci/Cosmology/Ptolemy.html#3 Simulation links: Planetary motion, Epicycles, physical cosmos
Homework	Problem Set 1 due 6 September
Week 3	What did Medieval humans know about the earth?
Sept. 6	Ancient and medieval understanding of the globe
Sept. 6 lab 1	Parallax
Sept. 8	Medieval physics of motion
Reading	Gregory, Chapter 2, Chapter 3, pp. 60-67, Wertheim, All is Number (coursepack) Lindberg, Medieval cosmos (coursepack)
Homework	Problem set 2 due 13 September
Week 4	First questioning of humankind's central position in the universe
Sept. 13	Medieval alternatives to geocentrism; Osiander's Preface to Copernicus (F. Gregory, guest lecture)
Sept. 13 lab 2	Seasons, Phases and epicycles (F. Gregory, guest lecture)
Sept. 15	What Copernicus Did : 4 different motions
Reading	Gregory, Chapter 3, pp. 45-51 http://www1.umn.edu/ships/galileo/library/cusa3.pdf Sections 156-166 (pp.89-95) Osiander's foreword and Copernicus' preface, www.geo.utexas.edu/courses/302d/Fall_2011/Full%20text%20-%20Nicholas%20Copernicus,%20_De%20Revolutionibus%20%28On%20the%20Revolutions%29,_%201.pdf (Scroll down just a bit to read "Foreword by Andreas Osiander". After reading this, scroll past the letter of Nicholas Schönberg to read Copernicus's dedication to the pope, "To His Holiness, Pope Paul III", Nicholas Copernicus' Preface to His Book on the Revolutions")
Homework	None
Week 5	Copernicus: last of the ancients or first of the moderns?
Sept. 20	Copernicus vs. Ptolemy
Sept. 20 lab 3	Measuring the circumference of the earth

Sept. 22	The Starry Messenger (Bronowski, film)
Reading	On the Revolution of the Heavenly Orbs Gregory, Chapter 4, pp. 80-89
Homework	Problem set 3 due 27 September
Week 6	Challenging and extending Copernicus
Sept. 27	Tycho's system and Kepler's First two laws
Sept. 27 lab 4	Motion in one dimension
Sept. 29	Kepler's Third Law and discussion - Why was Kepler a Copernican?
Reading	Gregory, Chapter 5 Watch a portion of "Harmony of the Worlds," (from 24:28 to 54:28) on youtibe: http://www.dailymotion.com/video/x1h5nu6_carl-sagan-s-cosmos-e03-harmony-of-the-worlds_tv Equivalence of the Tychonic and Copernican systems Kepler's 3 Laws
Homework	Problem set 4 due 4 October
Week 7	Heliocentrism gains a champion
Oct. 4	Inertial motion and Galileo's pendulum
Oct. 4 lab 5	Simple pendulum
Oct. 6	Galileo's *Starry Message* and the *Dialogues*
Reading	Gregory, Chapter 6 Observations of the moon, The satellites of Jupiter Galileo's Theory of the Tides Excerpts from The Dialogues
Homework	Problem set 5 due 11 October
Week 8	"There goes a man that writ a book that he nor anyone else understands"
Oct. 11	Newton's laws of motion
Oct. 11 lab 6	Force and mass
Oct. 13	Mid-term Exam
Reading	Gregory, Chapter 8 The Moon as a Falling Body See for yourself Assign different firing speeds and see result. Newton and the Apple
Homework	None
Week 9	Newton stands up to challenges
Oct. 18	Newton and the moon

Oct. 18 lab 7	Falling bodies and acceleration due to gravity
Oct. 20	Challenges to the Inverse square law
Reading	Gregory, Chapter 9, pp. 177-189; Chapter 7, pp. 140-145 Newton's General Scholium
Homework	Problem set 6 due 25 October
Week 10	Thermodynamics and the end of the universe
Oct. 25	An era of Many Forces
Oct. 25 lab 8	Absolute zero
Oct. 27	The End of the Universe (2nd Law of Thermodynamics)
Reading	Gregory, Chapters 15; 16, pp. 326-331, 339-end; and Chapter 20, pp. 419-25. Conservation of Mechanical Energy
Homework	Problem set 7 due 1 November
Week 11	How light sheds light on the universe
Nov. 1	Oersted, Ampere and the unification of electricity and magnetism
Nov. 1 lab 9	Index of Refraction
Nov. 3	Faraday, Maxwell, magnetic fields, light as electromagnetic wave
Reading	Gregory, Chapter 16, pp. 331-39; Chapter 20, pp. 411-18, 425-29, 431-33 Ronalds: *Francis Ronald's Electric Telegraph* (coursepack)
Homework	Problem set 8 due 8 November
Week 12	Was there a crisis in physics at the end of the 19th century?
Nov. 8	Michelson/Morley
Nov. 8 lab 10	Wavelength of Light
Nov. 10	Special Relativity
~Nov. 10	Optional pizza party/Film: "Bronowski: the Majestic Clockwork"
Reading	Gregory, Chapter 21 to p. 447 Michelson/Morley experiment
Homework	Problem set 9 due 15 November
Week 13	The end of determinism
Nov. 15	Early ideas of the quantum/ Quantum measurement and the role of observer
Nov. 17	Film: "Bronowski: Knowledge or Certainty"
Reading	Gregory, Chapter 21, pp. 447 to end, Chapter 25, pp. 522-24 Alistair McGrath, "In the Beginning" in the coursepack
Homework	Problem set 10 due 22 November

Week 14	Science loses its innocence
Nov. 22	Discussion of "Knowledge or Certainty", WWII and the atomic bomb
Nov. 24	Thanksgiving break
Reading	Gregory, Chapter 25, pp. 524-end
Week 15	Humanity's Place in the Universe: where did we come from & where are we going?
Nov. 29	General relativity
Dec. 1	Hubble, galaxies, and the expansion of the universe (microwave background radiation)
	Gregory, Chapter 27, to p. 576, pp. 581 to end Steven Weinberg, "The more comprehensible the universe is the more pointless it seems"
Week 16	The progress of science revisited
Dec. 6	The Future of the Universe
Final	Dec. 15, 10:00 a.m. - 12:00 p.m., NPB 1002