Discover the Universe
AST1002 Section 0428 Spring 2015

Instructor: **Assoc. Prof. Jonathan Tan**
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personal email: jt @ astro.ufl.edu
office hours: Tue. 12.50pm (Period 6) (following discussion section) or by appointment

Class Web site: www.astro.ufl.edu/~jt/teaching/ast1002/

Lecture time and place: Tuesdays: 10:40am-11.30am (period 4); Thursdays: 10.40am-12:35pm (periods 4 & 5) in Florida Gym (FLG) 280.

Optional Discussion sections (final times to be confirmed on class website): We will aim to have semi-regular discussion sections (especially in weeks leading up to exams, homeworks, observing project due dates) that will be held in the Bryant Space Sciences Building (BRT) room 217. Provisional times are immediately after main class lectures, i.e., Tue. 11.45am-12.35pm (period 5) & Thur. 12.50pm -1.40pm (period 6), but check class website.

Concepts and ideas covered in the lectures will be explored in more detail, and with greater opportunity for questions and discussion. Some guidance will be provided for homework questions, although solutions will not be given out before the homework is due. In the weeks before exams, these sections will also serve as the main review sessions. Students are strongly encouraged to attend and participate in these discussion sections and extra credit, up to 5%, can be gained in this way, as part of your participation grade. We will also have a web-based discussion forum for the class where you can post questions and discuss topics. Your participation here can also generate extra credit.

Required text: Astronomy: A Beginner's Guide to the Universe by Chaisson & McMillan, 7th Edition.

Pre-requisites and Co-requisites: None

Credits: 3

Course Contents: This course offers a broad overview of modern astronomy. We will examine how observation, experimentation and exploration have led to our present day understanding of the Earth environment and the Universe we live in. Although this is essentially a non-mathematical science course, a very basic knowledge of mathematics is required. Our goal is to help you gain a physical understanding and an appreciation of the cosmos and more generally of the scientific method and how scientific discoveries impact society. Along the way, we will use and practice critical thinking skills and learn how to formulate empirically testable hypotheses. (P)

The topics we will cover include: Motions of the sky; A historical development of our understanding of the solar system (an example of the scientific method); Light and telescopes; The properties of the planets within our solar system; The nature and lives of stars; The nature of our Milky Way Galaxy; Properties of other galaxies; The origin and fate of the Universe; The search for extraterrestrial life.

General Education: AST 1002 - Discover the Universe, is a GenEd physical science (P) course. As the list of topics above demonstrates, the course covers not only the Universe and the bodies in it—planets, moons, stars, galaxies, etc.—but also how we know about those things, making use of our understanding of the underlying physics of, e.g., orbits and radiation. The course will focus on major scientific developments in astronomy & astrophysics and their impacts on society and the environment.

Course and Gen Ed Student Learning Objectives:

• To provide students with a broad overview of modern astronomy. This will be accomplished through lectures and weekly reading assignments. Students will be able to define common astronomical terms and explain basic concepts and theories for a range of astrophysical phenomena.

• To teach students the scientific process and how we can understand the Universe using basic physical laws derived on Earth. This will be accomplished through lectures and in-class discussions as well as homework assignments. Students will gain an understanding of how the scientific method is applied to the field of astronomy.

• To review the major scientific developments in astronomy and summarize their impacts on society and our environment such as recognizing our place in the Universe, evaluating the validity of astrology, comparing energy sources, and how atmospheric effects of planets influence climate change. Students will be able to critically evaluate the difference between good science and bad science. Evaluations will be based on in-class discussions, exams and observing project.

• To teach scientific reasoning. Scientific reasoning is the use of logic, observations, and critical thinking to interpret the world around you. This will be accomplished through in-class discussions, homework assignments and the observing project. Students will formulate empirically-testable hypotheses derived from the study of physical processes and phenomena and apply logical reasoning skills through scientific criticism and argument. These skills will serve you well regardless of what career you pursue.

• To improve scientific literacy. Literacy in basic concepts & terminology of science is necessary if you wish to follow science news stories or make informed decisions (such as voting) on issues that pertain to science. This will be accomplished through in-class discussions about current news topics in astronomy & as part of the observing project.

• To help students learn to communicate scientific ideas clearly and effectively using oral, written or graphic forms. This will be done through in-class discussions (oral) and as the written component of the observing project.

Grading Information: See https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx for general UF grading policies. Your grade for the course will be based on the following:

Midterm 1 Exam: Midterm 2 Exam: Cumulative Final Exam:	15% 15% 30%	Tue., 2/3/15, 10.40am Tue., 3/24/15, 10.40am Tue., 4/21/15, 10.40am
Homework: Observing Project:	20% 20%	

Approximate grading scale:

Letter Grade	GPA	Letter Grade	GPA
A >=90%	4.0	C+ 74-76%	2.33
A- 87-89%	3.67	C 70-73%	2.0
		C- 67-69%	1.67
B+ 84-86%	3.33	D+ 64-66%	1.33
B 80-83%	3.0	D 60-63%	1.0
B- 77-79%	2.67	D- 57-59%	0.67
		E < 56%	0

Examinations (60% of grade): Two in-class examinations will be given during the semester. The final exam (30% of grade) will be cumulative on the entire course material. These exams will test the student's content knowledge but will emphasize applying critical thinking skills.

Observing Project (20%): One of the most enjoyable aspects of astronomy is actually observing the sky either with the eyes, binoculars or a telescope. Students are expected to attend an observing session at the campus observatory. These take place every clear Friday evening during the semester (directions to the observatory and times are provided in lecture and on the class web site). For your visit, you must complete an observing form (download from the class web site) describing in detail what the objects that you observe through the telescopes and explaining their astronomical significance. As part of this project you will research the object you observed using recent news or popular science articles and report on what you have learned beyond what has been discussed in lecture. You must also obtain a special token for each visit from the staff at the observatory and attach it to your form. Remember to put your name on your form. **Do not wait until the due date - it may be cloudy!**

Homework (20%): Homework will be used during the semester to facilitate and reinforce students understanding of the course material and encourage critical thinking. About 9 problem sets will be given online via the e-learning system. These problems will be similar but not identical to questions that will appear on the exams and are excellent preparation for the exams. No late homeworks will be accepted, but you will be able to drop your worst homework score. Your remaining homework scores will contribute to 20% of your grade.

Participation Extra Credit (5%): Up to 5% can be gained by attending and participating in Lectures, Discussion Sections, Review Sessions and the Web Forum (see above). Attendance will be recorded at the sections, and participation in discussions will be graded. More details will be given on the class website. Attendance in lectures will be taken from time to time and this will also be assessed towards extra credit. There may be additional opportunities to earn participation credit: pay attention in lecture.

Attendance, Class Participation and Conduct Policy:

- Attendance at lectures is expected.
- Students should arrive on time and not get ready to leave until the lecture is finished.

• Reading assignments will be given approximately once each week. These will consist of reading pages/chapters from the textbook. Students will read material that will be covered by the lectures the following week.
• We will provide basic lecture notes on the class web site at least 24 hours before each class. You should look these over, print them out and bring them to class. You should then make additional notes on these printouts.
• In order to stimulate critical thinking and gauge how well you understand the material, questions based on the lectures, reading assignments and projects/homework will be posed in class. Students should participate in the lecture by answering these questions and also by asking your own questions.

Make-up Policy: Students are expected to complete all requirements by the specified due dates. If a student misses class or an assignment due to an excused absence as specified in the undergraduate catalog and provides the instructor with timely notification, they will be allowed a reasonable time to make up the missed work. The format of a make-up test/exam will be at the discretion of the instructor.

Academic Honesty Policy:
• This is an excerpt from the Academic Honesty Guidelines and Student Conduct Code in the University of Florida Undergraduate Catalog: "*Academic Honesty: The university requires all members of its community to be honest in all endeavors. A fundamental principle is that the whole process of learning and pursuit of knowledge are diminished by cheating, plagiarism, and other acts of academic dishonesty. In addition, every dishonest act in the academic environment affects other students adversely, from the skewing of the grading curve to giving unfair advantage for honors or for professional or graduate school admission. Therefore, the university will take severe action against dishonest students. Similarly, measures will be taken against faculty, staff, and administrators who practice dishonest or demeaning behavior."*
• Cheating is not tolerated in this class. Everyone in this class is expected to follow the University of Florida Honor Code: *We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity.* Any student caught cheating will be referred to the Honor Code Chancellor.
• On all work submitted for credit by students at the university, the following pledge is either required or implied: *"On my honor, I have neither given nor received unauthorized aid in doing this assignment."*

Accommodations for Students with Disabilities:
• Students who require a classroom accommodation for a disability are required by UF policy to arrange accommodations themselves when needed.
• Students must first contact the Dean of Students Office of Disability Resources in Peabody 202 (phone: 352-392-1261). Please see the University of Florida Disability Resources website for more information at: http://www.dso.ufl.edu/drp/services/.
• The Dean of Students Office will provide documentation to the student who must then provide this documentation to the Instructor when requesting accommodation.

UF Counseling Services: On-campus resources are available at the UF Counseling & Wellness Center (392-1575) for students experiencing personal or stress related problems.

Approx. Course Calendar: see class website for more accurate calendar, especially when preparing for exams. Also see lecture notes for reading assignments

Lecture 1 1/6/2015, Introduction
Lecture 2 1/8/2015, Scientific Notation; Scale of Universe; Wave model of light and the electromagnetic spectrum; Light travel time; Celestial Sphere
Lecture 3 1/8/2015, Motions of Sun, Seasons, Motion and phases of the Moon
Lecture 4 1/13/2015, Solar & Lunar eclipses, Angular size
Lecture 5 1/15/2015, Motions of the planets, Ancient astronomy
Lecture 6 1/15/2015, Constellations, Ancient Cosmologies, Early Greek Astronomy, Physics of Aristotle
Lecture 7 1/20/2015, Ancient Greek Astronomy, Parallax, Precession, The Geocentric Model
Lecture 8 1/22/2015, Copernicus, Heliocentric Model, Brahe, Kepler & his 3 Laws, Galileo
Lecture 9 1/22/2015, Newton: Laws of Motion, Gravitation
Lecture 10 1/27/2015, Tides, Earth Structure & Evolution, Atomic Structure
Lecture 11 1/29/2015, Earth's Atmosphere & Oceans, Light (Blackbody radiation and Wien's Law), Kelvin temperature scale
Lecture 12 1/29/2015, Magnetic Field, Aurora

Midterm 1: 2/3/2015 in class

Lecture 13 2/5/2015, The Moon: structure, formation
Lecture 14 2/5/2015, Terrestrial planets: Mercury, Mars
Lecture 15 2/10/2015, Venus, Evolution of terrestrial planets, Introduction of Doppler Effect
Lecture 16 2/12/2015, Jovian (Gas Giant) planets
Lecture 17 2/12/2015, Rings and the Roche Limit, Moons of Jupiter
Lecture 18 2/17/2015, Saturn's Moons and Rings, Pluto and Dwarf Planets
Lecture 19 2/19/2015, Kuiper Belt, Oort Cloud, Comets, Asteroids, Impacts on Earth
Lecture 20 2/19/2015, Formation of the Solar System, The Nature of Known Exoplanet Systems
Lecture 21 2/24/2015, Particle (quantum) model of light, interaction with matter (Kirchoff's Laws)
Lecture 22 2/26/2015, Measuring properties of stars: temperature, composition, distance, flux, luminosity
Lecture 23 2/26/2015, HR Diagram, Stefan-Boltzman Law, Binary Stars (Doppler Effect)
Lecture 24 3/10/2015, Telescopes, The Sun, Sun Spots, Sun's energy source: nuclear fusion
Lecture 25 3/12/2015, Nuclear Fusion, Structure of the Sun and other stars
Lecture 26 3/12/2015 Star Formation: Molecular Clouds, Nebulae, Gas cores, disks, outflows
Lecture 27 3/17/2015, Star clusters, Mass limits of stars, Evolution of Low-Mass Stars (Red Giant, Planetary Nebula, White Dwarf, Binary Evol., Novae, Type I SN)
Lecture 28 3/19/2015, Evolution of Massive Stars (Red Supergiants, Type II Supernova, Neutron Star, Black Hole)
In class review 3/19/2015

Midterm 2: 3/24/2015 in class

Lecture 29 3/26/2015, Einsteins Theories: Special and General Relativity
Lecture 30 3/26/2015, Star Clusters as cosmic clocks, Mapping & Weighing the Galaxy, Dark Matter
Lecture 31 3/31/2015, The Galactic Center Supermassive Black Hole, Nebulae as other galaxies
Lecture 32 4/2/2015, Galaxy types, spiral density waves, galaxy evolution, active galaxies
Lecture 33 4/2/2015, The distribution of galaxies, Olbers' paradox, the expanding universe
Lecture 34 4/7/2015, Age and geometry of the universe, the Big Bang
Lecture 35 4/9/2015, The very early universe: Inflation; The future of the Universe
Lecture 36 4/9/2015, Life in the Universe: Origin on Earth,
Lecture 38 4/14/2015, Search for Extraterrestrial Planets and Life
Lecture 39 4/16/2015, Interstellar communication and travel, the Fermi Paradox
Lecture 41 4/16/2015, Overview – Our place in the universe

Final exam: 4/21/2015 in class