

**ASTRONOMY 309G: Current Topics in Astronomy
Fall 2014**

UNIQUE NUMBER: 48560

TIME, PLACE: T-Th 2:00—3:30 PM, WEL 3.502

INSTRUCTOR: Pawan Kumar – Professor of astrophysics, specializing in exploding stars

Office: RLM 17.204, **phone:** 512-471-3412

Email: pk@astro.as.utexas.edu

Hours: Tuesdays 1-2 PM or by appointment

TEACHING ASSISTANT: Rodolfo Santana

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Hour: Mondays 11:00 AM – 12:00PM & Wednesdays 11:00 AM-12:00 PM, or by appt.

This course may be used to fulfill three hours of the natural science and technology, Part I component of the university core curriculum and addresses the following four core objectives established by the Texas Higher Education Coordinating Board: communication skills, critical thinking skills, teamwork, and empirical and quantitative skills.

GRADES: There will be two hour-long examinations, each counting 25 percent of the final grade. Homeworks (roughly one every other week) will carry 20% of the grade. The remaining 30% of the grade will be based on about 11, 10 minute quizzes, and twice-a-week mini-quizzes (1-5 minutes long) spread randomly over the entire semester. These quizzes will be closed book & closed internet but you would be allowed to interact with people sitting close to you (however you MUST respect that some people like to work by themselves and you should not disturb them). **The exams are scheduled for 10/7 and 12/4.** The exams will be multiple choice. There will be no final exam. **There will be NO makeup exam unless there is a written note from a medical doctor or an appropriate official note from the university.** Plus/minus grading will be used for the final grade: 59.0 – 63.6 **D-**, 63.7 – 66.6 **D**, 66.7 – 69.6 **D+**, 69.7 – 72.6 **C-**, 72.7 – 76.6 **C**, 76.7 – 79.6 **C+**, 79.7 – 82.6 **B-**, 82.7 – 85.6 **B**, 85.7 – 88.6 **B+**, 88.7 – 92.0 **A-**, >92.0 **A**

Bonus Points: You can earn bonus points on HWs by doing extra problems as specified on a couple of home works. Class participation (asking and answering questions) can earn you an additional up to 10 points.

Policy on the use of electronic devices in class: You may use your laptop to take notes. However, use of all electronic devices for things unrelated to class/astrophysics is strictly prohibited. TAs will randomly monitor compliance with the policy, and you can lose 15% of total grade for each violation.

COURSE DESCRIPTION: This is a specialized course for non-science majors that will presume some knowledge of the basic astronomical concepts presented in Astronomy 301. A working knowledge of basic algebra and scientific notation ("powers of ten") is required, and some familiarity with calculus will be helpful.

COURSE CONTENT: Origin and Evolution of the Universe. Dark matter and dark energy and accelerated expansion of the universe and its ultimate fate. Birth, life and death of stars. Discussion of neutron stars and black holes and their fiery birth in supernovae & gamma-ray bursts. Supermassive black holes at the centers of galaxies. Search and detection of planets outside the Solar system.

TEXT required: **Your Cosmic Context: An Introduction to Modern Cosmology**, by Todd Duncan and Craig Tyler. published by Pearson Addison-Wesley

TEXT suggested:

Cosmology: The science of the universe, by Edward Harrison, Cambridge University Press.

Cosmic Catastrophes: Exploding Stars, Black Holes & Mapping the Universe, by J. Craig Wheeler, published by Cambridge University Press (this book is available for online reading at the UT library)

website: www.lib.utexas.edu)

DISCUSSION SESSIONS: Weekly help sessions will be held on **Mondays 5:00 to 6:00 pm in Welch 3.502** to discuss class material and exams. These sessions and office hours allow a more nearly one-on-one relationship and are a valuable addition to the lecture. In addition, **there will be a review session the day before each of the two exams** – the time and location will be posted on the *Blackboard* in advance.

DISABILITIES: Students with disabilities may request appropriate academic accommodations from the Division of Diversity and Community Engagement, Services for Students with Disabilities, 471-6259.

WEB SITE: Lecture slides & home works will be posted to the course *Blackboard* site.

ASTRONOMY 309

Current Topics in Astronomy

Syllabus

Setting the Stage: (Week 1 – 2)

Overview of The Universe

Basic laws of Nature: Electrodynamics, Strong & weak forces, gravity according to Newton and according to Einstein

The Universe: (Weeks 2 – 5)

Big bang theory, inflation, cosmic microwave background, formation of galaxies...

Dark matter, dark energy and accelerated expansion of the universe

Life Cycle of Stars (Weeks 6 – 7)

Birth, growing old, and death

Main sequence stars & white dwarfs

Stellar explosions (Weeks 8 – 9)

Supernovae & Gamma-ray bursts: birth of a Black Hole or a neutron star

Basic properties of Neutron stars

Black Holes (theoretical properties) (Weeks 9 – 10)

Event Horizon and Singularity

Orbits around Black Holes

Inside Black Holes

Black Hole Evaporation: Hawking Radiation

Accretion and growth of Black Holes

Observation of Black Holes (Weeks 11 – 12)

Stellar mass Black Holes: X-ray Novae & micro-quasars

Supermassive Black Holes at centers of galaxies (including H₂O-maser galaxies)

Planets outside of our solar system (Week 13 – 14)

Different observational techniques for detecting exoplanets

Distribution of Mass & distance from the central star etc.

Formation of planets & their migration

Life outside the solar system?