

**ASTRONOMY 309: Current Topics in Astronomy
Fall 2013**

UNIQUE NUMBER: 48525

TIME, PLACE: M-W 2:00—3:30 PM, WEL 3.502

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

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Hours: Tuesdays 2-3 PM or by appointment

TEACHING ASSISTANTS: **Rodolfo Santana** & **Wenbin Lu**

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Hours: Tuesdays 9:00 AM – 10:00AM & Thursdays 2:00 PM-3:00 PM, or by appt. (RLM 16.318)

GRADES: There will be two hour-long examinations, each counting 20 percent of the grade. Homeworks (roughly one every other week) will carry 20% of the grade. The remaining 40% of grade will be based on about 11, 10 minute quizzes, spread randomly over the entire semester. The top 10 quiz grades will be counted toward the final 40% quiz grade. Half of these quizzes will be closed book & closed internet and the other half will be open book, **but closed internet**, and you will 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 10/9 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.

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**)

HELP SESSIONS: Weekly help sessions will be held on **Tuesdays 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

1. Setting the Stage: (Week 1 – 2)
 - a. Overview of The Universe
 - b. Basic laws of Nature: Electrodynamics, Strong & weak forces, gravity according to Newton and according to Einstein
2. The Universe: (Weeks 2 – 5)
 - a. Big bang theory, inflation, cosmic microwave background, formation of galaxies...
 - b. Dark matter, dark energy and accelerated expansion of the universe
3. Life Cycle of Stars (Weeks 6 – 7)
 - a. Birth, growing old, and death
 - b. Main sequence stars & white dwarfs
4. Stellar explosions (Weeks 8 – 9)
 - a. Supernovae & Gamma-ray bursts: birth of a Black Hole or a neutron star
 - b. Basic properties of Neutron stars
5. Black Holes (theoretical properties) (Weeks 9 – 10)
 - a. Event Horizon and Singularity
 - b. Orbits around Black Holes
 - c. Inside Black Holes
 - d. Black Hole Evaporation: Hawking Radiation
 - e. Accretion and growth of Black Holes
6. Observation of Black Holes (Weeks 11 – 12)
 - a. Stellar mass Black Holes: X-ray Novae & micro-quasars
 - b. Supermassive Black Holes at centers of galaxies (including H₂O-maser galaxies)
7. Planets outside of our solar system (Week 13 – 14)
 - a. Different observational techniques for detecting exoplanets
 - b. Distribution of Mass & distance from the central star etc.
 - c. Formation of planets & their migration
 - d. Life outside the solar system?