

Lives and Deaths of Stars
ASTRONOMY BIZARRE (309N) COSMIC CATASTROPHES
Spring 2019 (Unique Number 46605)

TIME, PLACE: MWF 2:00-2:50 PM, PAI 3.02

INSTRUCTOR: J. Craig Wheeler - a theoretical astrophysicist specializing in exploding stars and related topics.

Office: RLM 17.230, phone: 471-6407

Email: wheel@astro.as.utexas.edu

Hours: MWF 5 - 6 PM or by appointment; do not hesitate to talk to me if you have questions or problems. My job is to help.

TEACHING ASSISTANT:

Caprice Phillips

Office: RLM 15.310E

Phone: NA

Email: clphillips@astro.as.utexas.edu

Hours: TTh 2:00 – 3:00 PM, or by appt.

GRADER

Alicia Montecinos

Office: NA

Phone: NA

Email: alicia.montecinos@utexas.edu

Hours: by appt.

GRADES: There will be five 50 minute long multiple-choice examinations each counting 20 percent of the grade. **The exams are scheduled for 2/8, 3/1, 3/29, 4/26 and 5/10.** *No exam is dropped.* There will be no final exam. Plus/minus grading will be used for the final grade; for example: 79.5 – 83.3 B-, 83.4 – 86.6 B, 86.7 – 89.4 B+. Averages above 93.4 get an A (no A+).

EXTRA CREDIT: sky watch project to identify objects or constellations containing objects such as supernovae, neutron stars, and black holes that are relevant to the course (5 points maximum added to each exam). Questions on exams about astronomy in the news (2 questions, 2 points maximum per exam). It is possible to get 107/100 points on each of the five exams (see Extra Credit).

COURSE DESCRIPTION: Specialized course for non-science majors that will presume knowledge of basic astronomical concepts presented in Astronomy 301. There will be a minimum of mathematics, but a familiarity with basic algebra and scientific notation (“powers of ten”) will be helpful.

LEARNING GOALS: by the end of the term you should understand the role of supernovae, neutron stars and black holes in modern astrophysics. You should also understand the connections of these phenomena with cosmic gamma-ray bursts, gravitational waves, worm holes, determining the origin, state, and fate of the Universe, and hints of extra dimensions (see Schedule).

TEXT: Cosmic Catastrophes: *Exploding Stars, Black Holes and Mapping the Universe*, Second Edition, published by Cambridge University Press. An electronic edition (20% download restriction) is available from the UT library.

EXAM REVIEW SESSIONS: Help sessions will be held on Thursdays before exams at 5:00 – 6:00 PM to discuss class material and exams. This review will be held in RLM 7.104.

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

CANVAS: Lecture notes, review sheets, exam keys and other important information.

SUPPLEMENTARY WEB SITE: <https://sites.cns.utexas.edu/ast309n/home#> for extra material, links, etc.

LECTURES ONLINE: This class will use the Lectures Online recording system. This system records the audio and video material presented in class for you to review after class. Links for the recordings will appear in the Lectures Online tab on the Canvas page for this class. You will find this tab along the left side navigation in Canvas. To review a recording, simply click on the Lectures Online navigation tab and follow the instructions presented to you on the page. These recordings will be available throughout the term. You can learn more about how to use the Lectures Online system at <http://sites.la.utexas.edu/lecturesonline/>.

UT Instapoll: We will experiment with this new class-room response system. More information at <https://utexas.instructure.com/courses/633028/pages/how-do-i-use-ut-instapoll-in-a-canvas-course>.

You Belong Here

A climate conducive to learning and creating knowledge is the right of every person in our community. Bias, harassment, and discrimination of any sort have no place here. If you notice an incident that causes concern, please contact the Professor, TA, and the Campus Climate Response Team (<http://diversity.utexas.edu/ccrt>)

Students with Disabilities

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Academic Integrity and the University Code of Conduct

A fundamental principle for any educational institution, academic integrity is highly valued and seriously regarded at The University of Texas at Austin. More specifically, you and other students are expected to maintain absolute integrity and a high standard of individual honor in scholastic work undertaken at the University.

The University Honor Code states: “The core values of the University of Texas at Austin are learning, discovery, freedom, leadership, individual opportunity, and responsibility. Each member of the University is expected to uphold these values through integrity, honesty, trust, fairness, and respect toward peers and community.”

Academic dishonesty includes: cheating, plagiarism, unauthorized collaboration, falsifying academic records, misrepresenting facts, multiple submissions, and any other acts or attempted acts that violate the basic standard of academic integrity.

Consequences of academic dishonesty can be severe. Grade-related penalties are routinely assessed but students can also be suspended or even permanently expelled from the University for scholastic dishonesty. Other potential consequences can be particularly far-reaching, such as the creation of a disciplinary record that may very well impact future opportunities. Furthermore, incidents of scholastic dishonesty diminish the overall value of scholastic achievements on this campus and reflect poorly on the University

Helpful resources:

Office of the Dean of Students: deanofstudents.utexas.edu/

Guide to Avoiding Plagiarism: www.utexas.edu/cola/centers/cwgs/_files/pdf-4/ai2012.pdf

Accommodations for Religious Holidays

By UT Austin policy, you must notify the professor of a pending absence at least fourteen days prior to the date of observance of a religious holy day. If you must miss a class, an examination, a work assignment, or a project in order to observe a religious holy day, you will be given an opportunity to complete the missed work within a reasonable time after the absence.

Emergency Procedures

In the event of an evacuation, follow the instruction of faculty or class instructors. Occupants of buildings on The University of Texas at Austin campus are required to evacuate buildings when a fire alarm is activated. Students requiring assistance in evacuation should inform their instructor in writing during the first week of class. Familiarize yourself with all exit doors of each classroom and building you may occupy and remember that the nearest exit door may not be the one you used when entering the building. Do not re-enter a building unless given instructions by the following: Austin Fire Department, The University of Texas at Austin Police Department, or Fire Prevention Services office.

Links to information regarding emergency evacuation routes and emergency procedures (including weather closures) can be found at: www.utexas.edu/emergency. For more information, contact the Office of Campus Safety and Security at 512-471-5767 or www.utexas.edu/safety/.

Behavior Concerns Advice Line (BCAL)

The Behavior Concerns Advice Line is a service that provides The University of Texas at Austin's faculty, students and staff an opportunity to discuss their concerns about another individual's behavior. This service is a partnership among the Office of the Dean of Students, the Counseling and Mental Health Center (CMHC), the Employee Assistance Program (EAP) and The University of Texas Police Department (UTPD). An individual can either call the line 512-232-5050 or report online at www.utexas.edu/safety/bcal/

ASTRONOMY 309N
Cosmic Catastrophes

Schedule

Lecture 1 – Discussion of Syllabus

Lecture 2 – The Universe is a strange place

Lecture 3 – Red giants, white dwarfs, supernovae

Lecture 4 – Historical supernovae

Lecture 5 – Extragalactic supernovae, common elements forged in stars

Lecture 6 – Categories of supernovae

Lecture 7 – Categories of supernovae (continued)

Exam 1

Lecture 8 – Gravity, thermal and quantum pressure

Lecture 9 – Evolution of massive stars

Lecture 10 – Evolution of massive stars, iron cores

Lecture 11 – Collapse of iron cores of massive stars, neutrinos

Lecture 12 – Formation of neutron stars, jets

Lecture 13 – Physics of exploding white dwarfs

Lecture 14 – Evolution of stars in binary systems

Lecture 15 – Accretion disks

Exam 2

Lecture 16 – Binary white dwarfs, gravitational radiation, light curves

Lecture 17 – SN 1987A

Lecture 18 – SN 1987A (continued)

Lecture 19 – Superluminous Supernovae

Lecture 20 – Neutron stars in binary systems, soft gamma-ray repeaters, magnetars

Lecture 21 – Black holes, history,

Lecture 23 – Newton versus Einstein, geometry

Lecture 24 – Curved space and gravity

Exam 3

Lecture 25 – Basic properties of black holes: event horizon and singularity

Lecture 26 – Black holes and time

Lecture 27 – Non-rotating, rotating black holes

Lecture 28 – Quantum gravity, Hawking radiation, fundamental properties

Lecture 29 – Observations of stellar-mass black holes

Lecture 30 – Gravitational waves, black hole and neutron star mergers

Lecture 31 – Supermassive black holes

Lecture 32 – Gamma-rays bursts, supernovae and black holes

Exam 4

Lecture 33 – Dark ages, dark matter, the expanding Universe

Lecture 34 – Supernovae and the Universe, the accelerating Universe, dark energy

Lecture 35 – Dark energy, quantum gravity, worm holes

Lecture 36 – Multiple dimensions, string theory

Lecture 37 – String theory, large extra dimensions, branes

Lecture 38 – String theory, brane worlds, string landscape, holographic universe

Exam 5