

PHY390 Special Topics Syllabus

Spring 2018

Instructor: James Lattimer, ESS 449 (2-8227, lattimer@astro.sunysb.edu),
Office Hours MWF 2:00-3:00

Meeting Times: TuTh 1:00 - 2:20

Course URL: www.astro.sunysb.edu/lattimer/AST390

Required Text: Schutz: A First Course in General Relativity, Second Edition. Also available online

[http://202.38.64.11/~jmy/documents/ebooks/Schutz A First Course in General Relativity\(Second Edition\).pdf](http://202.38.64.11/~jmy/documents/ebooks/Schutz%20A%20First%20Course%20in%20General%20Relativity%20(Second%20Edition).pdf)

Readings will be also assigned from a variety of sources. Much of the material is available as course lecture notes (see above URL).

In addition, it can be useful to consult the standard texts

- Black Holes, White Dwarfs and Neutron Stars, by Shapiro & Teukolsky
- Neutron Stars 1: Equation of State and Structure, by Haensel, Potekhin and Yakovlev
- Compact Objects in Astrophysics: White Dwarfs, Neutron Stars and Black Holes
- Introduction to Black Hole Physics, by Frolov & Zelnikov
- Principles of Stellar Evolution and Nucleosynthesis, by D.D. Clayton (McGraw-Hill: New York), 1968 and later

Description: This course covers many aspects of relativistic astrophysics, but will focus on black holes, neutron stars and gravitational radiation. In addition, nucleosynthesis, gamma-ray bursts, supernovae and relativistic cosmology will be studied.

Final Grade: The final grade will be compiled from weekly homeworks (40%) and two term reports (60%).

Homeworks: About 1 per week, including a few simple computer projects. Some experience in computer programming is assumed, since PHY 277 is a pre-requisite. Homeworks will be made available about 1 week before due date on Blackboard.

Term Reports: Due dates are 9 March and 20 April; late penalties apply. Suggested topics will be placed on the course website, but you may choose alternate topics of relevance to the course. Reports should be about 10-12 pages in length, at least, including bibliography. Try to use a scientific-style format, such as from AAS or APS, and submit as a pdf file to Blackboard. We may discuss some of the reports in class.

Lecture Outline

- 23-25 Jan.: A brief introduction to general relativity
- 30 Jan.-1 Feb.: Spherical solutions of general relativity; analytic solutions
 - 6-8 Feb.: Rotation of neutron stars and black holes, the equation of state
- 13-15 Feb.: Dense matter and nuclear properties
- 20-22 Feb.: Neutron star structure and properties
- 27-1 Mar.: Observations of white dwarfs and neutron stars
 - 6-8 Mar.: Orbits in general relativity
- 20-22 Mar.: Tests of general relativity
- 27-29 Mar.: Properties of black holes, black hole thermodynamics
 - 3-5 Apr.: Observations of black holes and the event horizon
- 10-12 Apr.: Gravitational radiation: sources, signals, detectors
- 17-19 Apr.: Observations of gravitational radiation
- 24-26 Apr.: Gamma-ray bursts and nucleosynthesis
 - 1-3 May: General relativity and cosmology

If you have a physical, psychological, medical or learning disability that may impact your course work, please contact Disability Support Services, ECC (Educational Communications Center) Building, room128, (631) 632-6748. They will determine with you what accommodations, if any, are necessary and appropriate. All information and documentation is confidential.

Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Faculty are required to report any suspected instances of academic dishonesty to the Academic Judiciary. Faculty in the Health Sciences Center (School of Health Technology & Management, Nursing, Social Welfare, Dental Medicine) and School of Medicine are required to follow their school-specific procedures. For more comprehensive information on academic integrity, including categories of academic dishonesty, please refer to the academic judiciary website at <http://www.stonybrook.edu/uaa/academicjudiciary/>

Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of Judicial Affairs any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn. Faculty in the HSC Schools and the School of Medicine are required to follow their school-specific procedures.