

PHY 7097 – MODERN ASTROPHYSICS – SPRING 2017

INSTRUCTOR: Prof. Imre Bartos
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OFFICE HOURS: by appointment

COURSE WEBSITE: <http://phys.ufl.edu/courses/phy7097/spring18/>

TEXTBOOKS: No required textbook. Recommended:
<http://iopscience.iop.org/book/978-0-7503-1369-8.pdf>

PREREQUISITE KNOWLEDGE AND SKILLS: Undergraduate math (derivation, integration) and undergraduate physics is required.

PURPOSE OF COURSE: The purpose of this course is to introduce students to some of the key phenomena and questions in modern astrophysics. We will cover compact objects such as black holes, neutron stars, and their emission mechanisms, as well as modern, large-scale observatories that were built to learn more about them (gravitational waves, neutrinos, gamma-rays and others).

COURSE GOALS AND OBJECTIVES: The course will give you an understanding of some of the main, actively researched topics in astrophysics. It will give you an understanding of the frontiers, where the field is going, as well as some of the modern observational tools.

COURSE EVALUATION: Students are expected to provide feedback on the quality of instruction in this course based on 10 criteria. These evaluations are conducted online at <https://evaluations.ufl.edu>. Evaluations will be open toward the end of the semester and students will be informed at that time. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/results>.

COURSE SCHEDULE:

- Week 1. Stars' end** (possible ends of stellar life cycles, including white dwarfs, core collapse, and disintegration)
- Week 2. Neutron Stars** (what neutron stars are, how they are formed, and their properties. Neutron star equation of state)
- Week 3. Black holes** (what black holes are, how they are formed, and their properties. Schwarzschild radius, spin, charge, mass, hair)
- Week 4. Supernovae** (types, explosion mechanisms, emission properties, remnants)
- Week 5. Accretion** (gas accretion onto black holes or neutron stars. Origin of accreted gas, geometry (Bondi/disk))
- Week 6. Astrophysical particle acceleration** (relativistic outflows, their formation, and how they accelerate particles. Cosmic rays, gamma rays, high-energy neutrinos)
- Week 7. Gamma-ray bursts** (history, properties, populations)
- Week 8. Afterglow emission** (origin, properties)
- Week 9. High-energy observatories** (most important observatories that detect cosmic rays, gamma rays, and high-energy neutrinos; observation principles)
- Week 10. The high-energy Universe** (what has been observed, observational techniques, open questions. Cosmic rays, gamma rays, high-energy neutrinos)
- Week 11. Gravitational waves** (definition, detection, astrophysical production)
- Week 12. Compact binaries** (formation channels, properties, eccentricity)
- Week 13. Searching for gravitational waves** (search techniques, challenges)
- Week 14. Kilonovae** (and other emission from compact binary mergers)
- Week 15. Cosmology with gravitational waves**
- Week 16. Multimessenger astrophysics and open questions**

DISCLAIMER: This syllabus represents the Prof. Bartos' current plans and objectives. As we go through the semester, those plans may need to change to enhance the class learning opportunity. Such changes, communicated clearly, are not unusual and should be expected.

COURSE POLICIES

ATTENDANCE POLICY: Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies that can be found at: <http://www.graduateschool.ufl.edu/media/graduate-school/pdf-files/handbook.pdf>.

GRADING: The final grade will be based on homework (30%) and a final exam (70%). Instead of taking the final exam, a student may give a lecture on an agreed-upon topic related to the course material. See also UF graduate grading policy at <http://www.graduateschool.ufl.edu/media/graduate-school/pdf-files/handbook.pdf>.

MATERIALS AND SUPPLIES FEES: None.

UF POLICIES

UNIVERSITY POLICY ON ACCOMMODATING STUDENTS WITH DISABILITIES: Students requesting accommodation for disabilities must first register with the Dean of Students Office (<http://www.dso.ufl.edu/drc>). The Dean of Students Office will provide documentation to the student who must then provide this documentation to the course professor when requesting accommodation. You must submit this documentation prior to submitting assignments or taking the quizzes or exams. Accommodations are not retroactive, therefore, students should contact the office as soon as possible in the term for which they are seeking accommodations.

UNIVERSITY POLICY ON ACADEMIC MISCONDUCT: Academic honesty and integrity are fundamental values of the University community. Students should be sure that they understand the UF Student Honor Code at <http://www.dso.ufl.edu/students.php>.

COMMUNICATION COURTESY: All members of the class are expected to follow rules of common courtesy in all emails, conversations, discussions, and chats. See <http://teach.ufl.edu/wp-content/uploads/2012/08/NetiquetteGuideforOnlineCourses.pdf>.

STUDENT COMPLAINTS PROCESS: UF has information on the complaints processes for residential students (see https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf) and for distance learning students (see <http://www.distance.ufl.edu/student-complaint-process>).

GETTING HELP

Resources are available at <http://www.distance.ufl.edu/getting-help> for:

- Counseling and Wellness resources
- Disability resources
- Resources for handling student concerns and complaints
- Library Help Desk support

Should you have any complaints with your experience in this course please visit <http://www.distance.ufl.edu/student-complaints> to submit a complaint.