PHYS 8150 Selected Topics in Astrophysics

Spring Semester, 2019
3 Credits

Course Time: by appointment

Instructor: Prof. Oleg Kargaltsev

Course Place: by appointment

Office Hours: by appointment

Office: Corcoran 407

Contact information (E-Mail): kargaltsev@gwu.edu

Prerequisites: core graduate physics courses, ability to code in C/Python, and Wolfram Mathematica, instructor's approval

Synopsis

After taking this course, students will be able to relate astronomical phenomenon to physics concepts and solve a set of problems from high-energy astrophysics using their prior physics and math knowledge. Students will also be provided with data-based tasks from modern astronomical observatories to explore a particular phenomenon related to astrophysics of compact objects. Course activities include reading of papers or notes assigned by the instructor, problem solving, answering instructor's questions. Use of Wolfram Mathematica for problem solving is strongly encouraged. Most of interaction may occur electronically (preferred method is e-mail but Skype is also possible). Face-to-face meetings should be requested ahead of time via e-mail.

Table 1. Course Objectives

Content Objectives	Skills Objectives
1. Become familiar with a wide range of complex astronomical phenomena 2. Learn how to find and isolate specific physical laws and concepts while describing a complex astronomical phenomenon	1. Problem-solving and analytical skills 2. Connecting astronomical phenomena with physics processes and laws.

Assessments and grade calculation:
- Problem solving at home (50%)
- Answering questions based on assigned reading (20%)
- Astronomical data analysis (30%)

Course Schedule. An approximate (can be adjusted by the instructor) schedule of topics covered in Spring 2019 course is shown below in Table 2.

Table 2. Classroom Schedule and Activities (assignments and deliverables in bold)

Week	Topics
1	Equation of state for a degenerate star. Mass-Radius relation for WDs.
2	Tidal disruption by a black hole or a neutron satr.
3	Measuring magnetic field using synchrotron radiation.
4	Cooling of neutron stars.
5	N-body systems with gravity.
6	Gravitational waves from solitary neutron stars.
7	Maximum possible luminosity. Geons.
8	Adiabatic Invariants. Astrophysical applications.
9	Turbulence. Kolmogorov's law. Relation between Fourier spectrum and autocorrelation function.
10	Equations of hydrodynamics. Sound waves. General approach to derive the dispersion relation in linear approximation.
11	Equations of hydrodynamics. Stationary solutions. de Laval nozzle. Critical point. Trans-sonic flow.
12	Parker model for stellar wind (isotropic gas outflow with gravity).

13	Energy loss due to sound waves. Connection to EM waves. Relation between the Fourier spectrum for the variability and spectrum of electromagnetic radiation.
14	Concluding remarks, student questions.

Course Format

This course is primarily assigned reading and problem solving at home. There is no single textbook for the course. Most problems will be based on research papers.

There are no exams in this course.

Grading: Numerical course grades translate into letter grades using the following scale:

≥ 94.00	**A**	70.00 – 73.99	**C**
90.00 – 93.99	**A-**	66.00 – 69.99	**C-**
86.00 – 89.99	**B+**	61.00 – 65.99	**D+**
82.00 – 85.99	**B**	55.00 – 60.99	**D**
78.00 – 81.99	**B-**	50.00 – 54.99	**D-**
74.00-77.99	**C+**	≤ 49.99	**F**

Absences and Excuses: There are no formal class meetings. However, students must read assigned papers and provide problem solution according to the schedule (see Table 2) unless agreed otherwise with the instructor.

Academic Integrity

Compliance with the GW Code of Academic Integrity is mandatory. The code states: "Academic dishonesty is defined as cheating of any kind, including misrepresenting one's own work, taking credit for the work of others without crediting them and without appropriate authorization, and the fabrication of information." For the remainder of the code, see: https://studentconduct.gwu.edu/code-academic-integrity

Support for Students Outside the Classroom

DISABILITY SUPPORT SERVICES (DSS)
Any student who may need an accommodation based on the potential impact of a disability should contact the Disability Support Services office at 202-994-8250 in the Marvin Center, Suite 242, to establish eligibility and to coordinate reasonable accommodations. For additional information please refer to: http://gwired.gwu.edu/dss/

UNIVERSITY COUNSELING CENTER (UCC) ***202-994-5300***
The University Counseling Center (UCC) offers 24/7 assistance and referral to address students' personal, social, career, and study skills problems. Services for students include: crisis and emergency mental health consultations, confidential assessment, and counseling services (individual and small group), and referrals.
http://gwired.gwu.edu/counsel/CounselingServices/AcademicSupportServices