Astronomy 4930: Special Topics
Neutron Stars and Black Holes

Course Dates for 2024 Fall:
August 22 – December 4

Lecture Times and Location:
Tuesdays at 10:40AM – 11:30AM (4) in McCarty Hall A (MCCA) 2196
Thursdays at 10:40AM – 12:35PM (4 – 5) in McCarty Hall B (MCCB) G086

Instructor:	Dr. Paul Sell
Office:	Bryant Space Sciences Center 222
Office Hours:	Mondays 2PM – 3PM, Tuesdays 3PM – 4PM, Wednesdays 2PM – 3PM, Fridays 1PM – 2PM, and by appointment
Contact Information:	psell@ufl.edu
Office Phone:	(352) 294–1867

Teaching Assistant:	Jess Chellino
Office:	Bryant Space Sciences Center 319B
Office Hours:	Mondays 11AM – 12PM, Thursdays 3:30PM – 4:30PM, and by appointment
Contact Information:	jchellino@ufl.edu
Office Phone:	(352) 294–1881

Course Website: Canvas/E-Learning

Textbook: *Accretion Power in Astrophysics*, 3rd (the newest) edition, by Frank, King, and Raine. Other references will be used for supplemental information throughout the course.

Brief Description: This course is intended for advanced undergraduate students in astronomy and astrophysics. This course centers on describing the observational and theoretical properties of compact objects (black holes and neutron stars). Prerequisites: AST3018 and AST3019. Though not required, students will benefit from various advanced physics courses, most notably: PHY3101, PHY3221, PHY3513.

Course Objectives/Goals: Students will be able to describe many of the fundamental physical structures and processes that occur around these compact objects through the process of accretion. Most generally, students with learn about the motions of matter and energy described

by special and general relativity, fluid descriptions of inflowing and outflowing matter, relevant radiative processes, and observational signatures of black holes and neutron stars.

Detailed Description of the Graded Course Structure

Class Participation: Regular class attendance is expected. See the university policy regarding excused absences: **https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/**. In-class work may occasionally be assigned.

Homework: Problem sets will be regularly assigned throughout the semester. Late homework will generally not be accepted.
Working in groups is allowed for homework assignments and (usually strongly encouraged) for in-class activities, although if you do, discuss the problem/solution and then write your own answers without looking at the other students' paper. Each student is required to show all work and submit separate homework solutions; no emailed work.

Project: A handout and discussion to explain the project fully will be provided when appropriate. All guidelines including due dates will be provided.

Note: there are no exams for this course.

Course Grade Summary Breakdown: Each of the components of class described above will be assigned the following weights to determine your final score:

- Class Participation: 20%
- Homework: 40%
- Project: 40%

Grading Scale: (https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx)

Score	Grade	Score	Grade	Score	Grade
90% – 100%	A	77% – 79%	B−	64% – 66%	D+
87% – 89%	A−	74% – 76%	C+	60% – 63%	D
84% – 86%	B+	70% – 73%	C	57% – 59%	D−
80% – 83%	B	67% – 69%	C−	< 57%	E

Class/University Policies

- Please put your phones and, unless you are taking notes, your laptops away during class: no Facebook, Twitter, texting, etc.

- You may need to make calculations, so you should always have available a scientific calculator in addition to your usual materials for taking notes.
- Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the Disability Resource Center by visiting disability.ufl.edu/students/get-started. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester. Classroom accommodations can only be provided after appropriate verification.
- Responsible citizenship among college students includes honesty and integrity in classwork; regard for the rights of others; and respect for local, state, and federal laws as well as campus standards. Students are responsible for understanding the standards of the "Code of Student Conduct" and the Student Handbook. From the Academic Honesty Guidelines and Student Conduct Code in the University of Florida Undergraduate Catalog: "Academic Honesty: The university requires all members of its community to be honest in all endeavors. A fundamental principle is that the whole process of learning and pursuit of knowledge are diminished by cheating, plagiarism, and other acts of academic dishonesty. In addition, every dishonest act in the academic environment affects other students adversely, from the skewing of the grading curve to giving unfair advantage for honors or for professional or graduate school admission. Therefore, the university will take severe action against dishonest students. Similarly, measures will be taken against faculty, staff, and administrators who practice dishonest or demeaning behavior." Any student caught cheating will be referred to the Honor Code Chancellor.
- Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at https://gatorevals.aa.ufl.edu/students/. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via https://ufl.bluera.com/ufl/. Summaries of course evaluation results are available to students at https://gatorevals.aa.ufl.edu/public-results/.

Campus Resources

Health and Wellness

- *U Matter, We Care*: If you or someone you know is in distress, please contact umatter@ufl.edu, 352-392-1575, or visit U Matter, We Care website to refer or report a concern and a team member will reach out to the student in distress.
- *Counseling and Wellness Center*: Visit the Counseling and Wellness Center website or call 352-392-1575 for information on crisis services as well as non-crisis services.

- *Student Health Care Center*: Call 352-392-1161 for 24/7 information to help you find the care you need, or visit the Student Health Care Center website.
- *University Police Department*: Visit UF Police Department website or call 352-392-1111 (or 9-1-1 for emergencies).
- *UF Health Shands Emergency Room / Trauma Center:* For immediate medical care call 352-733-0111 or go to the emergency room at 1515 SW Archer Road, Gainesville, FL 32608; Visit the UF Health Emergency Room and Trauma Center website.

Academic Resources

- *E-learning technical support*: Contact the UF Computing Help Desk at 352-392-4357 or via e-mail at helpdesk@ufl.edu.
- *Career Connections Center*: Reitz Union Suite 1300, 352-392-1601. Career assistance and counseling services.
- *Library Support*: Various ways to receive assistance with respect to using the libraries or finding resources.
- *Teaching Center*: Broward Hall, 352-392-2010 or to make an appointment 352- 392-6420. General study skills and tutoring.
- *Writing Studio:* 2215 Turlington Hall, 352-846-1138. Help brainstorming, formatting, and writing papers.
- *Student Complaints On-Campus*: Visit the Student Honor Code and Student Conduct Code webpage for more information.
- *On-Line Students Complaints*: View the Distance Learning Student Complaint Process.

Tentative Class Schedule

Week #	Topics
1	Introduction to the course, basic properties and observations of BHs/NSs
2	Special relativity
3	Special and General relativity
4	General relativity
5	General relativity
6	Basics of Fluid and Thermodynamics
7	Bondi Accretion
8	Viscosity
9	Thin Accretion Disks
10	Limitations of the Thin Disk Description
11	Thick Disks, Jets, and Outflows
12	Disk Radiative Processes and Observational Properties
13	BH/NS Miscellaneous Topics, Project Presentations
14	Project Presentations
15	Project Presentations