

PHY 420/520: Astrophysics  
Fall 2018

Time: Tues./Thurs. 2:00 pm - 3:15 pm, S281

Instructor: Dr. Jon M. Saken  
Office: S178 (Science Bldg.)  
Phone: 696-2753  
E-mail: saken@marshall.edu

Office Hours: Tues./Thurs. 10:00 - 11:00 am; Wed. 10:00 am - 12:00 pm  
Final Exam: Thursday, Dec. 13, 12:45 pm - 2:45 pm  
Required Text: *Astrophysics for Physicists*; Choudhuri; Cambridge University Press; 2010

**Catalog Description:**

(3 hours) A detailed study of core problems in Astrophysics such as orbital dynamics, radiation processes, stellar structure and evolution, galactic dynamics, and cosmology.

**Fuller Course Description:** In this course we will investigate how the laws of physics are applied in astrophysical settings. Examples include Newtonian gravity and orbital motions; electrodynamics, Maxwell's Equations, and fluid dynamics and their applications to plasmas, stellar interiors, and the interstellar medium; interactions of matter and radiation; and galactic dynamics. Topics will vary somewhat year to year depending on student interest and new developments in astrophysics.

**Grading:**

A	90 - 100
B	80 - 89
C	70 - 79
D	60 - 69
F	0 - 59

Homework	15%
Computational Projects(2)	25%
Tests (3)	60%

**Homework:** Although some homework will be drawn from the textbook, students will also be exposed to important results from classical astrophysics and current literature. PHY520 students should expect a more theoretical treatment in their homework problems as well as more advanced practice in magnetohydrodynamics, fluid dynamics, and high energy astrophysics.

**Computational Projects:** Students will write code to model and/or simulate astrophysical processes and compare their results to the observational evidence. Examples include stellar interiors, orbits of exoplanets, destruction of dust grains, etc. Topics will be chosen in consultation with the instructor. Projects for PHY520 students will draw more heavily from current techniques being developed for modern studies in astrophysics, such as Monte Carlo simulations and Bayesian statistics.

## Course Outline (some topics subject to student interest):

Interactions of Radiation and Matter  
Astrophysical Plasmas  
Star Formation  
Stellar Atmospheres  
Stellar Interiors  
Exoplanets  
Important Processes in High Energy Astrophysics  
Galactic Dynamics  
Galaxy Interactions  
Cosmology

Plus additional topics/material from recent scientific discoveries.

## University Policies:

By enrolling in this course, you agree to the University Policies listed below. Please read the full text of each policy by going to <http://www.marshall.edu/academic-affairs> and clicking on “Marshall University Policies.” Or, you can access the policies directly by going to:

<http://www.marshall.edu/academic-affairs/policies/>

Academic Dishonesty/ Excused Absence Policy for Undergraduates/ Computing Services Acceptable Use/ Inclement Weather/ Dead Week/ Students with Disabilities/ Academic Forgiveness/ Academic Probation and Suspension/ Academic Rights and Responsibilities of Students/ Affirmative Action/ Sexual Harassment

## Course Policies:

- **ALL** work submitted must be typed (word-processed) and stapled with your name written clearly on the front. No exceptions.
- Any work handed in late will suffer a 10% penalty per **calendar** day. This does not apply for any day for which there is an excused absence.
- Makeup work will **NOT** be allowed except for *documented* emergencies. Students who must miss class for pre-approved university functions are expected to notify their instructor sufficiently far in advance to allow alternative arrangements to be made for any missing work.
- If you must miss a class contact me immediately. Also, be sure to let me know at least a week ahead of time if a university activity will require an absence from class.
- If you do miss a class, even for an excused absence, contact me immediately if you are unsure what was covered or what you need to make up. If you wait too long to discuss a make up you may be denied the opportunity to do so.
- Cell phone use is not permitted in the classroom. Please turn cellphones to OFF or vibrate while in class.

- Except for calculators, *all other electronic devices must be turned off in class*. Laptops, tablets, etc. Research has shown that not only do students retain more of the material when they take notes by hand, but also that laptops and tablets are a distraction to other students. So put them away during class time.
- Any act of academic dishonesty of any kind will result in a final grade of **F** for the class.

<b>Learning Outcomes</b> <i>Students will:</i>	<b>Practice</b>	<b>Assessment</b>
Apply established physical laws to astrophysical processes.	Homework	Exams
Investigate the similarities of phenomenae across a wide range of spatial and temporal scales.	Homework, Readings	Exams
Examine the role of experiments, observations, models, and theories in refining our understanding of the Universe.	Homework, Readings	Exams, Project
Compare the types, roles and degrees of uncertainty in science.	Homework, Readings	Exams, Project
Develop a model to explain some aspect of an astronomical object or process	Homework, Project	Project