

# PHY 453-3

## Topics in Physics and Astronomy: Special and General Relativity

University of Wisconsin-La Crosse – Spring 2015

Meeting Times: (LECTURE 3cr) 221 Cowley Hall, TuTh 12:40-2:05p

<p>Instructor: <b>Rob Salgado</b> Office: <b>116 Cowley Hall</b> (<i>shared office space</i>)</p> <p>Physics Dept main: 2005 Cowley Hall, (608)-785-8429</p>	<p>Office hours: <b>TBA</b> <i>Feel free to drop by my office desk [but you may wish to first check if I am there].</i></p>
<p>Email (the <b>best</b> way to contact me): <a href="mailto:rsalgado@uwlax.edu">rsalgado@uwlax.edu</a></p> <p>1) using your UW-L email address only... 2) with “ 453 ” somewhere on the Subject Line.</p>	

### Course Description:

This is an introduction to special and general relativity, with an emphasis on the spacetime-geometric viewpoint. We will begin exploring the less-intuitive but experimentally-verified features of relativity by a more careful analysis of time and space, using spacetime diagrams (with its non-euclidean geometry). Eventually, we develop (as needed) the necessary tools of vector and tensor calculus and differential geometry. Topics include relativistic kinematics, dynamics (particle collisions), Maxwell's Equations for Electromagnetism, Einstein's Field Equations, and the Schwarzschild Black Hole solution.

### Textbook:

***Gravity: An Introduction to Einstein's General Relativity*** by James Hartle (978-0805386622), which I will refer to from time to time and eventually follow more closely in the later part of the class. In the first part of the course, we will focus on new approaches that I am developing. Consult <http://www.visualrelativity.com/>

### Electronic Materials:

I will maintain a D2L website that links to announcements, homework assignments and solutions, electronic-whiteboard notes, and handouts. Consult this frequently. (These materials are not a substitute for regular attendance, participation, and problem-solving. The whiteboard notes are a substantial but *incomplete* record of what was discussed and done during class. They should supplement---not replace---your own notes. Generally, they will be posted within 24 hours after the class meeting. Revised versions may be posted in response to any errors brought to my attention.)

### Learning Objectives:

When you complete this class, you will be able to:

- Analyze situations in Relativity (including Mechanics and Electrodynamics) using various methods: graphical, geometrical, algebraic (including vector and tensor algebra and calculus).
- identify and use methods of inquiry appropriate to solve physics problems,
- use mathematical and logical methods to solve problems (in physics, and hopefully in other subjects!).

### GRADES:

Your grade is determined by the quantity and quality of your submitted solutions to homework that is assigned periodically. (Homework should be submitted into the D2L dropbox for our class. Scans or photographs should be legible.) You are encouraged to work with others (as long as you declare your collaboration for each problem). However, each student must write up his or her own solution. There are no quizzes or exams.

### RESPONSIBILITIES:

Please read the entire syllabus carefully. You are responsible for all of the requirements and procedures described here. You are also responsible for all announcements, assignments, changes, etc., whether or not you are in class.

- As an instructor, my responsibility is to find ways to help you learn how to solve physics problems.

### COURSE POLICIES AND PROCEDURES:

**Special Needs** - Any student with a documented disability (e.g., physical, learning, psychiatric, vision, hearing) who needs to arrange reasonable accommodations must contact the instructor and the Disability Resource Services office (165 Murphy Library, 785-6900) at the beginning of the semester. It is your responsibility to communicate your needs with the instructor in a timely manner.

**Religious Observances** - Students may complete exams or other requirements that are missed because of a religious observance provided arrangements are made within the first two weeks of class.

**Academic Standards** - The academic conduct and discipline procedures outlined in Chapter 14 of the University of Wisconsin-La Crosse Student Handbook will be followed. You are responsible for being familiar with these. Students are welcome to work together, exchange ideas, etc. However, EACH STUDENT MUST MAKE HIS/HER OWN MEASUREMENTS AND OWN CALCULATIONS. Copying someone else's measurements or calculations is cheating and will be handled accordingly.