

# PHYS 428/628: Relativity

## Classes

Place: Online

Time: MW 9:00–10:15

Classes will be recorded and posted on Blackboard.

Web site: [www.physics.gmu.edu/~joe/PHYS428.html](http://www.physics.gmu.edu/~joe/PHYS428.html)

## Instructor

Joe Weingartner (call me Joe)

[jweinga1@gmu.edu](mailto:jweinga1@gmu.edu)

Office hours: M 1:00–2:00, R 11:30–12:30, or by appointment

## Optional Textbooks

Relativity: *Special, General, and Cosmological*, 2nd ed, W. Rindler (Oxford University Press)

Introduction to Electrodynamics, 3rd ed, D. J. Griffiths (Prentice Hall)

## Evaluation

### Homework (100%)

1. You are encouraged to discuss the problems with one another, but the detailed solutions that you submit must be your own, independent work.
2. Do not hesitate to seek help from me, in person or by email.
3. The point value of each problem is indicated in brackets.
4. Homework will be due at the start of class on the announced dates. Late homework will only be accepted in extenuating circumstances.
5. The clarity of your solutions will factor significantly into your grade. It is not sufficient to write a few equations. You must define your variables, draw well labeled figures where appropriate, and explain what you're doing. Use the distributed solutions to sample problems and homework problems as a guide for the level of detail required. Also, you must write legibly. I will not struggle to decipher handwriting; instead, I will simply assign zero points.
6. Each week, I will choose a fraction (possibly 100%) of the submitted problems to grade. Of course, I will not reveal in advance which problems will be graded. Your total earned points for each submission will be  $AB/C$ , where  $C$  is the total number of points in the graded problems,  $A$  is the number of points you earned on those problems, and  $B$  is the total number of points in the problems on which you made a serious effort.
7. Unless explicitly stated, you may not use computer programs like Mathematica.
8. When a problem asks you to “show” something, this should be interpreted as “derive” rather than “verify.”
9. Problem sets for PHYS 628 are longer than those for PHYS 428. The additional problems are more mathematically challenging and probe the physics to greater depth.

Letter grades for the course will be determined from total numerical grades as follows:

A range: 90-100%

B range: 80-90%

C range: 70-80%

D: 60-70%

F: < 60%

## Course Outline

1. Motivation for Special Relativity
2. The Foundations of Special Relativity
3. Spacetime and 4-vectors
4. Relativistic Mechanics
5. Introduction to Tensors
6. Electrodynamics
7. Introduction to General Relativity
8. Geodesics in Curved Spacetime
9. Curvature and Einstein's Field Equations
10. The Schwarzschild Metric and Applications
11. Introduction to Cosmology

## Recommended Reading (by topic)

1. Rindler 1.1 through 1.10; Griffiths 1.2, 7, 12.1.1, Appendix C
2. Rindler 2.1 through 2.8, 3.1 through 3.6, 4.3; Griffiths 12.1.2 and 12.1.3
3. Rindler 5.1, 5.4 through 5.6; Griffiths 12.1.4, 12.2.1
4. Rindler Ch 6 (omit 6.5 and 6.8); Griffiths 12.2.2 through 12.2.4
5. Rindler 7.1, 7.2
6. Rindler 7.3 through 7.7; Griffiths 12.3
7. Rindler 1.11 through 1.16
8. Rindler 8.3, 8.4, 10.1 through 10.4
9. Rindler 10.5, 10.6, 14.1, 14.2
10. Rindler 11.1, 11.2, 11.5 through 11.12
11. Rindler 16.1 through 16.5 (except 16.3), 17.2, 18.1 through 18.4

## Civility and Inclusion

The Department of Physics and Astronomy is committed to civility and inclusion. All members, including instructors and students, are expected to abide by the department's Code of Professional Conduct.

## University Resources

Academic Integrity

Disability Services

Learning Services

Student Support and Advocacy Center

Counseling and Psychological Services