# Physics 8160: General Theory of Relativity
# Spring 2024

**Tuesday/Thursday 11am-12:15pm**
**Stevenson 6-105**

**Instructor:**
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**Textbooks:**

1. Einstein, *The Meaning of Relativity*.
2. Carroll, *Spacetime and Geometry: An Introduction to General Relativity*.

**Further reading:**

- Thorne, *Black Holes and Time Warps* (for historical background).
- Misner, Thorne & Wheeler, *Gravitation* (for physical insight and comprehensiveness).
- Wald, *General Relativity* (for greater mathematical rigor).
- Baez & Muniain, *Gauge Theories, Knots and Gravity* (for more differential geometry).
- Tong, *Lectures on General Relativity* (for a different take; available online) and Zee, *Einstein Gravity in a Nutshell* (for a very different take).

**Course description:** This course is a graduate-level introduction to general relativity. Topics covered include: Riemannian geometry; the principle of equivalence; Einstein's field equation; the Schwarzschild solution; the Newtonian limit; experimental tests; black holes. The prerequisites are: classical mechanics and electrodynamics, and multivariable calculus.

**Course format:** This is a traditional lecture course, except that I will sometimes ask you to do short calculations in class. Questions in class are encouraged. Carroll's textbook is excellent, and I will follow his development in Chapters 1-5 fairly closely. The ideal way to learn is to read the text *before* class, so that you may ask me any questions you have about the material as I cover it—for this reason, I will assign weekly reading from Carroll. Doing the assigned reading before class will help you and everyone else in the class.

**Homework:** There will be weekly homework assignments, which you may discuss with your classmates but should write up on your own. These assignments will be due at the beginning of lecture and solutions will be handed out at the end. To receive full credit, you must *clearly and legibly* explain your reasoning *with English sentences*. You are not allowed to use computer packages, and should derive your answers by hand. Late homeworks will not be accepted for credit except for ONE free pass, provided that you do not look at the solutions.

**Exam and grading:** The final will be a 48-hour take-home exam which will count as two homework sets. Grading will be based on homeworks, the final exam, and to a smaller extent class participation.