PHYS-6910: RELATIVITY
Syllabus, Spring 2019

Instructor
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Meeting: Tue—Thu 1.30-2.45pm, in UR 103.

Office hours: Tue, Thu 3.00-4.00, or by appointment.

Course description

Foundations of spacetime physics. Survey of the basics of special and general relativity, the description of curved spacetime, and the Einstein equations. Exact solutions, applications, tests, and the mathematical techniques of general relativity. For graduate (6000 level), additional assignments will be required.

Subjects covered include:

- A review of Physics in flat space according to Special Relativity
- Differential geometry tools, manifolds and curvature
- Gravitation, the equivalence principle and Einstein equation
- Applications to black hole physics, gravitational waves and cosmology
- Current applications in string theory: the AdS/CFT correspondence
- Computer software for General Relativity computations

Goals

- Become familiar with the formulation of physics in flat and curved spacetime.
- Be able to use differential geometry tools (connection, metric, curvature tensors), to describe gravitational phenomena according to General Relativity.
- Understand the basics of black hole physics and thermodynamics.
- Become familiar with solutions to the Einstein equations for applications in cosmology and string theory.
- Use the computer to perform calculations in General Relativity.

Text

The course will be based on the following lecture notes, downloadable from arxiv.org:

- S.M. Carroll, *Lecture notes on General Relativity* [arxiv:gr.qc/9712019].

Further reading, at a level comparable to the lecture notes, is provided by the books:

- S.M. Carroll, *Spacetime and geometry: an introduction to General Relativity*, Addison-Wesley (2004).

- B. Schutz, *A first course in General Relativity*, second edition, Cambridge University Press (2009).

Advanced texts include the classic books:

- S. Hawking and G. Ellis, *The large-scale structure of space-time*, Cambridge (1973).
- C. Misner, K. Thorne and J. Wheeler, *Gravitation*, Freeman (1973)
- S. Weinberg, *Gravitation and cosmology*, Wiley (1972)
- R. Wald, *General Relativity*, Chigago University Press (1984).

Homework

Homework sets will be posted on Canvas every two weeks.

Exam

There will be a final exam, but no midterm exam.

Grading

The grade will be based on the homework and final exam according to the following weights:

- Homework: 75%
- Final exam: 25%

DRC syllabus statement

USU welcomes students with disabilities. If you have, or suspect you may have, a physical, mental health, or learning disability that may require accommodations in this course, please contact the Disability Resource Center (DRC) as early in the semester as possible (University Inn # 101, 435-797-2444, drc@usu.edu). All disability related accommodations must be approved by the DRC. Once approved, the DRC will coordinate with faculty to provide accommodations.