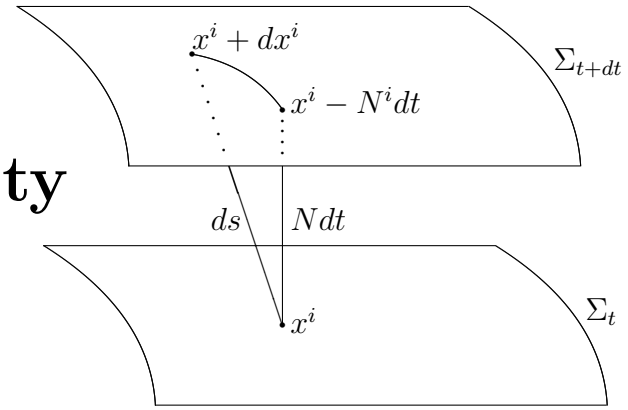
Physics 260

Introduction to General Relativity

Fall 2005



Professor: Steve Carlip
Room 437 (Physics-Geology)
Office hours to be announced

Text: Sean Carroll, *Spacetime and Geometry*
Supplementary text: Bernard Schutz, *A First Course in General Relativity*

Grading:

Homework	65%
Paper	35%

The required paper will be a short (6-8 page) paper treating a topic in theoretical or experimental gravitation in some depth. Papers are due Monday, December 12. Please have me approve your topic in advance; I can then recommend references and readings.

This will be an introductory course on general relativity, stressing both mathematical foundations (differential geometry and curved spacetime) and physical applications (observational tests, gravitational waves, black holes, cosmology). I will not assume any prior knowledge of differential geometry, but students should be comfortable with special relativity, vector analysis, and the basics of partial differential equations. Course topics will include:

1. Curved spacetime, the principle of equivalence, and motion in a gravitational field: a not-very-mathematical introduction, with an emphasis on observational tests
2. Introduction to modern differential geometry (manifolds; vectors, tensors, and forms; connections and geodesics; curvature)
3. The Hilbert action principal and the Einstein field equations
4. The weak field approximation: the Newtonian limit and gravitational radiation
5. Spherically symmetric solutions: the Schwarzschild solution, stars, and black holes
6. Homogeneous and isotropic cosmologies and the big bang

If there is time left at the end of the quarter, we can look at whatever topics the class is interested in.

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