

GENERAL RELATIVITY

PHYS 415

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Assessment: 65% final exam; 28% homework (4 assignments @ 7% each);
7% participation in problems classes.

Classes: Mon (ER260), Wed (ER260), Fri (E12); all @ 12pm.

Recommended text: S.M. Carroll, *Spacetime and geometry: An introduction to general relativity*, (Addison-Wesley, 2004)

Other useful references:

General relativity at introductory level:

R. d'Inverno, *Introducing Einstein's relativity*, (Oxford Univ. Press, 1992)

J.B. Hartle, *Gravity: An introduction to Einstein's general relativity*, (Addison-Wesley, 2003)

B.F. Schutz, *A first course in general relativity*, (Cambridge Univ. Press, 1985).

J. Foster and J.D. Nightingale, *A short course in general relativity*, 2nd ed., (Longman, London, 1995).

General relativity with greater depth / more topics:

R.M. Wald, *General relativity*, (Univ. of Chicago Press, 1984).

S.W. Hawking and G.F.R. Ellis, *The large scale structure of spacetime*, (Cambridge Univ. Press, 1973).

C.W. Misner, K.S. Thorne and J.A. Wheeler, *Gravitation*, (W.H. Freeman, San Francisco, 1973).

S. Weinberg, *Gravitation and Cosmology: Principles and applications of the general theory of relativity*, (Wiley, New York, 1972).

A.P. Lightman, W.H. Press, R.H. Price and S.A. Teukolsky, *Problem Book in Relativity and Gravitation*, (Princeton Univ. Press, 1975)

Related topics:

B.F. Schutz, *Geometrical methods of mathematical physics*, (Cambridge Univ. Press, 1980).

N.A. Doughty, *Lagrangian interaction: An introduction to relativistic symmetry in electrodynamics and gravitation*, (Addison Wesley, Sydney, 1990).

Course outline:

- * Special relativity (a brief overview)
- * Equivalence principle
- * Riemannian differential geometry (*a major chunk of the course*)
- * Covariant electrodynamics – Maxwell equations with differential forms
- * Einstein's equations * Weak-field limit of G.R.
- * Variational principle in curved spacetimes
- * Symmetry principles – Killing vectors
- * Spherical symmetry (Schwarzschild solution: stars, black holes)
- * Classical tests of G.R. (deflection of light, planetary orbits etc)