

# General Relativity (M24)

H.S. Reall

General Relativity is the theory of space-time and gravitation proposed by Einstein in 1915. It remains at the centre of theoretical physics research, with applications ranging from astrophysics to string theory. This course will introduce the theory using a modern, geometric, approach.

Course website: [www.damtp.cam.ac.uk/user/hsr1000](http://www.damtp.cam.ac.uk/user/hsr1000)

## Desirable Previous Knowledge

This course will be self-contained, so previous knowledge of General Relativity is not essential. However, many students have already taken an introductory course in General Relativity (e.g. the Part II course). If you have not studied GR before then it is strongly recommended that you study an introductory book (e.g. Hartle or Rindler) before attending this course. Certain topics usually covered in a first course, e.g. the solar system tests of GR, will not be covered in this course.

Familiarity with Newtonian gravity and special relativity is essential. Knowledge of the relativistic formulation of electrodynamics is desirable. Familiarity with finite-dimensional vector spaces, the calculus of functions  $f : R^m \rightarrow R^n$ , and the Euler-Lagrange equations will be assumed.

## Introductory Reading

1. Gravity: An introduction to Einstein's General Relativity, J.B. Hartle, Addison-Wesley, 2003.
2. Relativity: Special, General, and Cosmological, 2nd ed., W. Rindler, OUP, 2006.

## Reading to complement course material

There are many excellent books on General Relativity. The following is an incomplete list:

1. General Relativity, R.M. Wald, Chicago UP, 1984.
2. Spacetime and geometry: an introduction to General Relativity, S.M. Carroll, Addison-Wesley, 2004.
3. Advanced General Relativity, J.M. Stewart, CUP, 1993.
4. Gravitation and Cosmology, S. Weinberg, Wiley, 1972.

Our approach will be closest to that of Wald. Carroll's book is a very readable introduction. Stewart's book is based on a previous version of this course. Weinberg's book gives a good discussion of the Equivalence Principle.