General Relativity (M24)

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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.

This is a second course on General Relativity, albeit one that could just about be followed without prior exposure to the subject. The first half of the course will give an introduction to differential geometry, the mathematics that underlies curved spacetime. The second half of the course will discuss the physics of gravity.

Prerequisites

Familiarity with Newtonian gravity, special relativity, finite-dimensional vector spaces and the Euler-Lagrange equations is essential. Knowledge of the relativistic formulation of Maxwells equations is highly desirable.

Most students attending this course have already taken an introductory course in General Relativity (*e.g.* the Part II course). If you have not studied GR before then you should read 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.

Literature

1. R.M. Wald, *General Relativity.* Chicago UP, 1984.
2. C.W. Misner, K.S. Thorne and J.A. Wheeler, *Gravitation.* W.H. Freeman, 1973.
3. S. Weinberg, *Gravitation and Cosmology.* Wiley, 1972.
4. J.B. Hartle, *An Introduction to Einstein's General Relativity.* Addison–Wesley, 2003.
5. W. Rindler, *Relativity: Special, General and Cosmological*, 2nd edition, OUP 2006.
6. H. Reall, *Part III General Relativity*, available at http://www.damtp.cam.ac.uk/user/hsr1000/part3_gr_lectures.pdf.
7. D. Tong, *Lectures on General Relativity*, available at http://www.damtp.cam.ac.uk/user/tong/gr.html.

Additional support

Four examples sheets will be provided and four associated examples classes will be given. There will be a one-hour revision class in Easter Term.