Lorenzo Sorbo

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You can contact me at any time during work hours. Send an email or call to make sure I am in.

Class meets: TuTh 1:00-2:15, LGRT 1033

Textbook:


Course description:

This course provides a detailed description of the main aspects of General Relativity, the theory that links Gravity and Special Relativity. I will follow a geometrical formulation of the theory. Therefore I will spend a significant amount of time dealing with the concepts of manifold, of connection and of metric. Then I will move to the more physical aspects, studying in detail the properties of Schwarzschild solution and of the Friedmann-Robertson-Walker cosmological metric. This last subject will allow me to describe briefly the history of our Universe and to introduce cosmological inflation. If time allows, I discuss perturbation theory and/or gravitational radiation. I will follow rather closely the textbook, but departures may occur.

Grading:

The grading will be based on the final (30%), mid-term (30%) and 8-10 homework sets (40%).

Homework will be assigned in class on Thursday and will be due at the end of the lecture after two lectures (i.e. on the subsequent Thursday in most cases). Exceptions may occur. Late homework will get 75% of the credit if turned in before the beginning of the subsequent lecture; no credit if turned in later than this limit. Teamwork on the homework is welcome. However, please be aware that it is your responsibility to thoroughly understand all the homework you turn in.

The dates of the mid-term and of the final exams will be announced shortly. The final exam will be cover the whole course.
Syllabus

• **Manifolds**
  - Minkowski space, Lorentz group
  - Manifolds
  - Vectors, dual vectors, tensors
  - The metric tensor
  - Covariant derivative, parallel transport, geodesics
  - Riemann tensor, Ricci tensor

• **Schwarzschild metric**
  - Schwarzschild solution, Birkhoff’s theorem
  - Geodesics of Schwarzschild metric
  - Singularities, horizons
  - Rindler space
  - Kruskal coordinates, conformal diagram

• **Cosmology**
  - Friedmann-Robertson-Walker metric
  - Solutions of Friedmann equation
  - Redshift
  - Thermal history of the Universe
  - Inflation

• **Perturbation theory and gravity waves (if time allows)**
  - Perturbation theory and gauge transformations
  - Gravitational waves