

Short Description of GR course at IPM

Lecturer: *M.M. Sheikh-Jabbari*

Relativity, special and general, has been the corner stone of developments in physics in the last century. Relativity on top of the other things, provides a different measurement theory for all observables, that they should be Lorentz invariant or invariant under general coordinate transformations and in this way provides the dictionary to translate measurements of various observers. Based on this general idea and framework, the equivalence principle arises, which is then formulated into the theory of Einstein gravity.

In this course we will start with a brief review of special relativity as the starter. Then briefly discuss relativistic classical quantum field theory. As the preparation to Einstein GR we build mathematics needed for that purpose, that is differential and manifold geometries at a very basic level. This course is of course not meant to be a course in differential geometry. After building the needed mathematics we introduce Einstein GR and discuss some of its solutions and their properties, in particular the black hole geometries and gravity waves. We continue on studying various other solutions to Einstein GR with different sources and discuss their physics and implications.

The main text of the course will be the book by
T. Padmanabhan,
Gravitation, Foundations and Frontiers
By Cambridge University Press, 2010.

Warnings: My intention is to cover the whole book in this semester. Therefore, it will be a heavy work and demanding course. The book has many built-in exercises which are essential part of the course. It is expected that the students attending the class do all the exercises. I expect that all the students, those who have formally registered or otherwise alike, to attend the lectures regularly.

The classes will be on **Saturday and Wednesday morning 8-10 am** in *Farmanieh Bldg classroom*. The course will start from **Mehr 9th**.

We will have tutorial sessions the time of which will be fixed later.

Interested students are all kindly asked to contact department secretary Ms Pileroudi, niloufar@theory.ipm.ac.ir, providing their name, institution (or affiliation) and level (Masters or PhD). For non-IPM students there is the possibility of formally registering for the course as a “guest student”. For the latter please arrange the formal details with Ms Pileroudi.