General Relativity (Spring 2016)

PHYS-UA-170

Professor and Teaching Assistant

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Main textbook (Hard copy not required, but might be nice)

Gravity: An Introduction to Einstein's General Relativity, J. B. Hartle, Addison-Wesley 2003

This text takes a slightly unconventional approach to teaching GR from a physicists approach as opposed to a mathematicians approach. We'll use this book as a conceptual skeleton for the course, but material may come from elsewhere as well.

Some general references

A First Course in General Relativity, B. Schutz

Very pedagogical, offers the more mathematical interpretation of covectors as linear functionals. Nice geometric review of special relativity.

The Classical Theory of Fields, L.D. Landau and E. M. Lifshitz

Classic text. Terse but beautiful, unique discussion of the *gravitational* stress-energy tensor (since Landau invented it). Also ideal for reading on Brighton Beach as conversation starter.

Spacetime and Geometry: An Introduction to General Relativity, S. Carroll

Nice, rigorous book that's also fairly pedagogical. Go here for precise definitions of manifolds and diffeomorphisms, while still retaining their physical relevance and not getting lost in the mathematical weeds.

Gravitation, C. Misner, K. Thorne and J.A. Wheeler

The mother of all GR text books. Even the strongest among us buckle at the knees in Her presence. Kind of a zany "1 track" vs "2 track" system to allow you to avoid things that are too mathematical. Great reference for visualizing differential forms and creepy

spiritual physics angels at the end. Also a fantastic door-stop if physics doesn't end up being your cup of tea.

General Relativity, R. Wald

Probably the most advanced book on this list, but indispensable for future reading on GR with spinors. Good supplement when easier books fail.

Geometrical Methods of Mathematical Physics, B. Schutz

Another classic Schutz text. This book doesn't have anything to do with GR specifically but you'll notice in the course that physicists and mathematicians have an orthogonal way of thinking about differential geometry. This book helps bridge that gap if you look something up on wikipedia or n-lab and want to throw up.

String Theory Vol 1 & 2, J. Polchinski

Technically GR is just the infrared limit of the spin-2 sector of closed string theory so everything you need to know about this course is in here. Good Luck.

Homework Weekly assignments graded by Lord Geoff. Points for completion and accuracy as well as bonus ducats for presentation. (50% of grade)

Recitation (H 18:20-7:35, Rm 333 Meyer) The weekly recitation sessions are primarily for discussion of the weekly homework assignments. On occasion they may be used as a supplement to the lectures.

Examinations and Grading There will be a take home midterm over spring break, which you will complete in teams (roughly 4 teams of 4) (30% of grade). There will be a final exam in the form of a hackathon (2 teams, roughly 8 vs 8) incorporating various material from the course as well as physics/coding chops you might have acquired in other courses or during the hackathon. The winning teams receives an A for this component and the losing team a B (20% of grade).

Lecture Schedule (MT 6:30-7:45, Rm. 333 Meyer)