General Relativity (Physics 225A)
Fall 2013

Lectures:

MW 2–3:20, Mayer Hall 5301

Lecturer: John McGreevy

Mayer Hall 5222; email: mcgreevy at physics.ucsd.edu

Office Hours:

Mondays, after lecture – 5:00, or by appointment.

Thursday before colloquium is also often a good time to find me.

Use of the Web:

The course web page is

http://physics.ucsd.edu/∼mcgreevy/f13/.

Problem sets, solutions, lecture notes, handouts, announcements, *etc* will be distributed via this page. You should check it regularly (*e.g.* before each lecture) for new material. It will help to look at the relevant lecture notes *before* the lecture happens.

Content:

An introduction to a certain classical field theory which does a good job of describing the dynamics of gravity.

Texts:

I do not plan to follow any textbook very closely. My posted lecture notes will be the main text.

I will attempt to refer you to some relevant sections of the following books, most of which have been placed on reserve at S&E Library (or are available electronically):

Einstein Gravity in a Nutshell, by Anthony Zee.

This new textbook by Zee is wonderful and, like his Quantum Field Theory book, you should all keep it by your bedside.

General Relativity, by Robert Wald.

This book takes a very formal approach to the subject.

Introducing Einstein's Relativity by Ray D'Invierno.

This book gives a nice tangible introduction to the subject. It has lots of nice illustrations. Unfortunately, I didn't find it in the UCSD library.

The Classical Theory of Fields, volume 2 of the Landau-Lifshitz series.

Classic, terse, full of physics insight.

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Spacetime and geometry : an introduction to general relativity, by Sean Carroll.
Gravity : an introduction to Einstein's general relativity, James B. Hartle.

These books came out after I learned the subject, and I don't know them well. But people seem to like them.

A relativist's toolkit : the mathematics of black-hole mechanics, by Eric Poisson.

This is a more advanced book, beyond the scope of this course, but it is good so I am recommending it.

A First Course in General Relativity, by B. Schutz.

More concise than d'Inverno.

Gravitation and Cosmology, by S. Weinberg.

Even 40 years ago when he wrote this book, Weinberg missed no opportunity to decorate every symbol with as many indices as possible. The book is nevertheless full of wisdom.

Theory and Experiment in Gravitational Physics, by C. Will.

Where to look for discussion of experimental tests of the foundations of GR.

Grading:

Grades will be determined by problem sets and class participation.

Problem sets:

Problem sets are a very important part of this course. Sitting down yourself and trying to reason your way through a problem not only helps you learn the material deeply, but also develops analytical tools fundamental to a successful career in science. I recognize that students also learn a great deal from talking to and working with each other. I encourage each student to make his/her own attempt on every problem and then, having done so, to discuss the problems with one another and collaborate on understanding them more fully. Such collaboration adds most to the understanding of those participants who have done the most by themselves first. The solutions you write up after any discussion and then submit must reflect your own work. They must not be transcriptions or reproductions of other people's work.

In doing the problems, you should feel free to use whatever computational software (*e.g. Mathematica*) you find useful; please make a note in your write-up when you do so.

Problem sets will be posted on the course web page

http://physics.ucsd.edu/∼mcgreevy/f13/hw.html .

They will generally be due at the beginning of lecture.

Miscellaneous unsolicited advice about how to do well in this class:

Come to lecture! I will post my lecture notes, but they are intended as a supplement to what is presented in lecture, not a substitute.

Because of the existence of the posted lecture notes, you don't need to drive yourself crazy trying frantically to record everything that happens in lecture.

Keep up with the material. Review the lecture notes from previous lectures before the next one. The structure of this course is a bit of an experiment, and I am relying on all of you to follow its twists and turns. I will post the relevant reading assignments in advance; read ahead.

Start the homework problems as early as possible. Give yourself some time to think about them, and keep them in mind when you are reading and in lecture.

Ask lots of questions: in lecture, in office hours, in discussion section. The fact that you can ask questions is the point of having classes and not just letting everyone learn on their own.