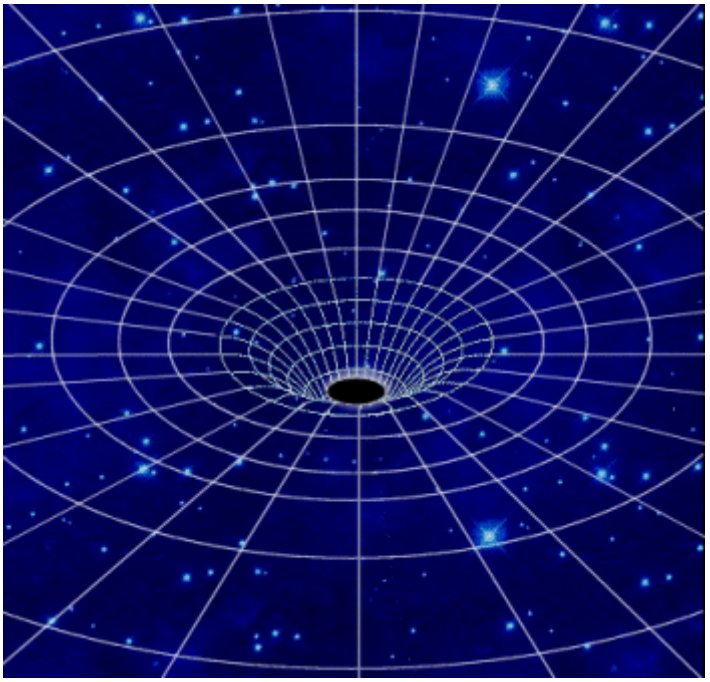
Physics 10: Gravity and Relativity (Winter 2011)



I am very excited to be teaching a Physics 10 on the topic of Gravity and Relativity in Winter 2011! If you've ever wondered about black holes or are interested in finding out what relativity is all about, this course is for you. Einstein's theory of general relativity is one of the most important ideas in 20th-century physics, but because of its mathematical complexity is usually reserved for graduate students. In this course, by thinking about concepts rather than equations and restricting ourselves to mathematically simple situations, you will come to understand the ideas without a lot of math. That doesn't mean the course is dumbed down; understanding the concepts will be challenging enough, but the reward is that you will truthfully be able to say that you understand Einstein's theory of general relativity!

Lectures: TR 9-10:20am in 55 Roessler

Instructor: Prof. David Wittman, 754-5354, dmwittman@ucdavis.edu. Feel free to contact me if you'd like more information.

Office Hours: TBD, Physics 529

Textbook: You do not have to buy a textbook. I will provide a free PDF file of everything you need to read.

Prerequisites: None. High school physics will help somewhat, but it is by no means essential. You should also be comfortable with basic algebra.

More specifics on topics covered: We will build our understanding in much (but not exactly) the same order that pioneering scientists such as Galileo, Newton, and Einstein built theirs. We will start with Galileo's notion of relativity (yes, he had one three centuries before Einstein). Then we follow in Newton's footsteps as we come to understand how the same force that makes an apple fall also makes the Moon go around the Earth. Related to Newton's conception of gravity is the equivalence principle. We will develop this principle a bit more than Newton did, and show that simply following this principle would lead us to predict most of the amazing effects (such as clocks running slower near black holes) that are associated with general relativity.

Next, we jump two centuries forward as we learn about special relativity. SR contains some counterintuitive notions about space and time, but they are straightforward consequences of the fact that the speed of light is constant and the same for all observers, and SR's predictions have been experimentally verified in exhaustive detail. The counterintuitive effects are really noticable only for objects traveling near the speed of light (which is why we have no intuition about them) but conceptually they are very important so we will work very hard to understand them thoroughly.

Finally we come to the crowning achievement: understanding how gravity fits in with the ideas of special relativity. Newton's gravity simply doesn't fit, so we must develop a new theory of gravity that *is* consistent with SR. That theory is called general relativity, and by the end of the course and after a lot of hard work, you will really understand it!