

Lecturer:

Prof. Richard Hughes, 3046 Physics Research Building, 614-688-5690

Email: hughes@mps.ohio-state.edu

Course Web Address: http://www.physics.ohio-state.edu/~hughes/freshman_seminar/

Office hours will be posted on the above web address.

Texts : This course will make extensive use of publicly web pages from current and future High Energy Physics and Astrophysics experiments. In addition, some material will be used, which is freely available on the web from The National Research Council of the National Academies.

Course Description: Particle physics and astronomy have seen incredible gains over the past twenty years. And yet, though particle physics concerns the very small, and astronomy concerns the extremely large, it is clear that these two disciplines are very closely related. This course will introduce the non-expert to these most exciting sciences, and describe the major research aims of each. We will focus on important questions at the intersection of physics and astronomy that have some hope of being answered over the next decade. As an example, astronomers have shown that all galaxies are held together by a form of matter that is different from any other matter we are aware of, and gives off no light. Scientists have named this dark matter, and are actively trying to find the source of this matter. Another example deals with particles called neutrinos. At this moment 30 billion of these particles are flying through every square centimeter of your body every second. For most of the past few decades, physicists thought these particles were massless. However, recent experiments have demonstrated conclusively that these particles indeed have mass, although it is quite small. Unfortunately, the nature of the experiments is such that they did not measure the particles' mass!

This course will review the major Particle and Astroparticle Physics experiments going on around the world, and how they will address the most important questions in these fields. These experiments generally involve hundreds of scientists, cost hundreds of millions of dollars (or more), and last for many years. Particular emphasis will be paid to experiments that Ohio State faculty are involved in.

Course Format: The course will meet once per week. The students will be expected to investigate the week's topic prior to each class using the web resources. It is expected that this investigation should take approximately 30-40 minutes per week. The classes will be organized as 48 minute "News Conferences", in which the Lecturer will discuss one of the science experiments. The students will act as reporters, whose **task is to write up a summary of the news conference**. As reporters, they are not expected to be experts, but the readings should help them form intelligent questions to ask during the news conference. **The summary should consist of a few paragraphs** describing the science experiment, and should include commentary on: the relative importance of the science, its cost and timescale, and the likelihood that the experiment will achieve its desired goals. The summary would be expected to be of a quality that might appear in the local newspaper.

Grade Weights: Class Participation based on questions asked at the "News Conferences" (30%); Summary Write-ups (70%). There will be a total of 8 summaries submitted, each consisting of a few paragraphs. The first summary will be due after the Week 3 lecture "Studying quarks and leptons using protons and anti-protons!".

- Weeks 1,2:** Introduction: Discovering the instruction manual for the Universe
Reference: <http://particleadventure.org/particleadventure/>
- Week 3:** Studying quarks and leptons using protons and anti-protons! (**OSU Involvement**)
- Explore the CDF Experiment web pages: <http://www-cdf.fnal.gov/pubcdf.html>
- Explore the D0 Experiment web pages: <http://www-d0.fnal.gov/public/index.html>
- Week 4:** Dark Matter: Most of the matter in the universe can't be found! (**OSU Involvement**)
- Explore the GLAST web pages: <http://www-glast.stanford.edu/>
- Week 5:** Matter and Antimatter (**OSU Involvement**)
- Explore the BaBar Experiment web pages: <http://www-public.slac.stanford.edu/babar/>
- Week 6:** Our sun is a neutrino factory and 30 billion neutrinos are flying through every square centimeter of your body every second. Ouch!
- Learn about NUMI-MINOS: <http://www-numi.fnal.gov/public/index.html>
- Week 7:** Looking for Mr. Higgs and Susy
- Explore the ATLAS experiment web pages: <http://atlasinfo.cern.ch/Atlas/public/Welcome.html>
- Explore the CMS experiment web pages: <http://cmsinfo.cern.ch/Welcome.html/>
- Week 7:** The earth is bombarded by particles: Where are the cosmic rays coming from?
- Explore the Auger web page: <http://www.auger.org/>
- Week 9:** Why is the universe accelerating? What is Dark Energy?
- Explore the SNAP web pages: <http://snap.lbl.gov/>
- Week 10:** The Important Questions to be addressed in particle physics and astronomy in the next decade.
- Read the National Academies summary: <http://www.nap.edu/execsumm/0309074061.html>

This document was created with Win2PDF available at <http://www.daneprairie.com>.
The unregistered version of Win2PDF is for evaluation or non-commercial use only.