

Radiation: Sources, Detection, and Safety

Phys 576, Spring 2022

Instructor: Alejandro Garcia

Course description:

Students will learn some basic concepts on nuclear physics, the processes that can produce radioactivity and to recognize dangerous versus safe environments, practical experience with high-resolution photon detectors, the basics of particle accelerators and practical experience with our own tandem accelerator, the basics of Rutherford scattering and how it can be used to identify minute amounts of contaminants, the basics of the functioning of nuclear reactors, and some concepts on nuclear astrophysics.

Syllabus:

1. The atomic nucleus. Basic nuclear physics. Nuclear energy. Orders of magnitude.
2. Attenuation of photon radiation. Solid state detectors. Practical working with Ge and Si detectors.
3. Ranges of ions and electrons. Radioactivity and radiation damage and health risks: Alpha, beta, gamma activity and neutrons.
4. Counting statistics.
5. Functioning of accelerators. Tuning beam through our own accelerator.
6. Rutherford scattering. Deciphering the mystery spectrum and the contents of the mystery foil.
7. Fission and fusion. The functioning of reactors.
8. Nuclear resonances. Nuclear astrophysics: nucleo-synthesis in stars.
9. Basics of Shell Model. Approximate predictions using simple models. Using quantum numbers and predicting decay rates.