

## Nuclear Physics

**Catalog:** The study of nuclear phenomena and properties including mass, stability, magnetic moment, radioactive decay processes and nuclear reactions. The application of nuclear principles to other fields such as astronomy, engineering, manufacturing, and medicine.

**Hours:** 3 hours (3 lecture/0 lab)

**Prerequisites:** Modern Physics, Quantum Physics (Co-requisite), Differential Equations or Calculus III (Co-requisite)

**Campus Numberings:**

Midwestern State University	PHYS 4373	Texas A&M University-Corpus Christi	PHYS 3490:310
Prairie View A&M University	PHYS 3243	Texas A&M University-Kingsville	PHYS 4460
Tarleton State University	PHYS 437	Texas Southern University	PHYS 366
Texas A&M University-Commerce	PHYS 437	West Texas A&M University	PHYS 4360

**COURSE LEARNING OBJECTIVES:**

<b>Course Goals</b> Upon completion of this course, students will	<b>Assessment</b>
1. be able to describe experimental setups and results concerning the existence and basic properties of the nucleus including size, density, magnetic moment, etc.	Embedded Course Assessment
2. be able to describe experimental evidence which contradicted the possible existence of electrons in the nucleus.	Embedded Course Assessment
3. be able to apply nuclear models including liquid drop, Fermi gas, and shell model to solve problems including the calculation of nuclear binding energy, nuclear stability, and the spins and parities of nuclear ground states.	Embedded Course Assessment
4. be able to apply nuclear energy level diagrams to solve problems involving alpha, gamma, and isobaric decay.	Embedded Course Assessment
5. be able to apply nuclear reaction models and energy level diagrams to make simple nuclear reaction calculations including determining Q-values, threshold energies, and resonance energies.	Embedded Course Assessment
6. be able to describe the various accelerator systems and their subcomponents including ion sources, vacuum pumps, optics, and analyzing magnets and contrast the accelerator system's potential applications.	Embedded Course Assessment
7. be able to describe various particle and photon detectors and contrast their characteristics (efficiency, cost, resolution, etc).	Embedded Course Assessment
8. be able to list the various parts of a pulse height analysis system for both time and energy analysis and be able to describe the function of each component.	Embedded Course Assessment
9. be able to calculate the attenuation of photons for various shielding materials and thicknesses using either tabulated data or computer simulation software.	Embedded Course Assessment

10. be able to calculate the energy loss and straggling for a charged particle interacting with matter using either tabulated data or computer simulation software.	Embedded Course Assessment
11. be able to describe the application of nuclear physics principles and instrumentation to other fields such as astrophysics, nuclear engineering, materials characterization, and medicine.	Embedded Course Assessment
12. be able to apply nuclear physics concepts including elastic scattering and energy loss to determine the composition and thickness of thin films.	Embedded Course Assessment
13. be able to describe the primary effects of ionizing radiation on biological tissue and be able to answer questions involving radiation safety.	Embedded Course Assessment
14. be able to summarize the theoretical Rutherford scattering cross section's dependence upon the scattering angle, incident ion's energy and atomic number, and target atom's atomic number.	Embedded Course Assessment
15. be able to analyze problems involving radioactive decay including determining half-life, disintegration constant, and activity.	Embedded Course Assessment