Elective Courses - List B

PHY 671 - Advanced Nuclear Physics

Course Code & Number	Course Name	C.H.	Lec.	Lab.	Tut.
PHY 671	Advanced Nuclear Physics	4	4	0	0

Syllabus

Basic Concepts: *History and overview, Some introductory terminology, Nuclear properties, Units and dimensions.*

Elements of Quantum Mechanics: *Quantum behavior, Principles of quantum mechanics, Problems in one dimension, Problems in three dimensions, Quantum theory of angular momentum, Parity, Quantum statistics, Transitions between states.*

Nuclear Properties: *Nuclear radius, Mass & abundance of nuclides, Nuclear binding energy, Nuclear angular momentum, Parity, Nuclear electromagnetic moments.*

Nuclear Models: *The Shell model, Even-Z, even-N nuclei and collective structure, More realistic nuclear models.*

Radioactive Decay: *The radioactive decay law, Production and decay of radioactivity, Growth of daughter activities, Types of decays, Natural radioactivity, Radioactive dating, Units for measuring Radiation.*

Alpha Decay: *Why alpha decay occurs, Basic alpha decay processes, Alpha decay systematics, Angular momentum and parity in alpha decay.*

Beta Decay: *Energy release in β decay, The "classical" experimental tests of the Fermi theory, Angular momentum & parity selection rules, Comparative half-lives & forbidden decays.*

Gamma Decay: *Energetics of gamma decay, Classical electromagnetic radiation, Angular momentum and parity selection rules, Angular distribution and polarization measurements, Internal conversion, Lifetimes for gamma emission.*

Nuclear Reactions: *Types of reactions and conservation laws, Energetics of nuclear reactions, Isospin, Reactions cross sections, Experimental techniques, Coulomb scattering, Nuclear scattering, Compound-nucleus reactions, Direct reactions.*

Nuclear Fission: *Why nuclei fission, Characteristics of fission, Energy in fission, Controlled fission reactions, Fission reactors, Fission explosives.*

Nuclear Fusion: *Basic fusion processes, Characteristics of fusion, Controlled fusion reactions, Thermonuclear weapons.*

References

- K.S. Krane, Introductory Nuclear Physics, Wiley, 1988.
- W.E. Burcham, M. Jobes, Nuclear and Particle Physics, 2nd Edition, John Wiley & Sons Inc, 1995.
- A. Guran, M. Cloud, W.B. Zimmerman, The Quantum World of Nuclear Physics, World Scientific, 2005.