



NUCLEAR AND PARTICLE PHYSICS

PROF. POULOSE POULOSE

Department of Physics
IIT Guwahati

PRE-REQUISITES : Basic Quantum Mechanics

INTENDED AUDIENCE : UG and PG students of Engineering Physics/Physics

COURSE OUTLINE :

The first part of the course will discuss nuclear physics. Properties of nuclei and details of popular nuclear models, properties of nuclear decays and nuclear reactions will be discussed in brief, but in a self-consistent manner. The second part will discuss the basics of particle physics. In this part, the fundamental forces and the dynamics of elementary particles under these forces will be considered. After introducing relativistic quantum mechanics, relativistic formulation of Maxwell's Equations and quantum electrodynamics will be discussed. This will be developed into the weak and strong nuclear forces based on the principle of gauge symmetry. The course will also introduce the physical principles of particle accelerators and detectors, including a very brief picture of the modern day complex detectors.

ABOUT INSTRUCTOR :

Prof. Poulouse Poulouse is affiliated to the Department of Physics, Indian Institute of Technology Guwahati since 2004. He is currently a Professor of Physics at IITG, and the Head of the Department of Physics. He completed his Ph.D. in Particle Physics Phenomenology from the Physical Research Laboratory, Ahmedabad in 1997 before spending his time as postdoctoral fellow at Tata Institute of Fundamental Research (1997-1999), Indian Institute of Science, Bangalore (1999-2001), RWTH-Aachen, Germany (2001-2002). Professor Poulouse has about 25 years of research experience including his PhD years with about 32 publications in international research journals, and has teaching experience of about 12 years teaching at the UG and PG courses at IIT Guwahati. He has taught a wide range of topics including Classical and Quantum Mechanics, Electrodynamics, Nuclear and Particle Physics, High Energy Physics, and Quantum Field Theory. He has taught the course of Nuclear and Particle Physics to the M.Sc. students of IIT Guwahati multiple times, and has also developed and delivered a course with the same title on the NPTEL (phase 2) platform. The Swayam-MOOCs course on Nuclear and Particle Physics intended to the Masters students is based on this NPTEL course.

COURSE PLAN :

Week 1: Basic Properties of the Nucleus

Week 2: Nuclear Force

Week 3: Nuclear Models

Week 4: Radioactive Decays

Week 5: Nuclear Reactions

Week 6: Particle Accelerators and Detectors

Week 7: Modern Complex Detectors

Week 8: Elementary Particles and Fundamental Forces

Week 9: Quark Model, Structure of protons and neutrons

Week 10: Relativistic Quantum Mechanics, QED

Week 11: Scattering Theory

Week 12: Gauge Symmetry & Electroweak Symmetry Breaking: Higgs Mechanism