# Physics of nuclei and particles

## Prof. Giuseppe Nardelli

***COURSE AIMS AND INTENDED LEARNING OUTCOMES***

This course aims at providing students with an introduction to nuclear and particle physics. By the end of the course, the students will have an introductory understanding of scattering theory, relativistic kinematics, groups theory (with applications to particle physics). Students will be also able to discuss the main features and processes of the fundamental interactions.

**COURSE CONTENT**

Scattering Theory: scattering as a time dependent perturbation. Cross sections. Scattering amplitudes in non-relativistic quantum mechanics. Born approximation.

Relativistic kinematics and relativistic scattering. Lorentz group and Minkowski space-time. Conservation rules in relativistic processes. Compton scattering.

Historical introduction to particle physics. Atomic nucleus, Alpha and beta decays. The particle “zoo”: photons, leptons, neutrinos, baryons, mesons, antiparticles.

Discrete symmetries and groups. Parity, charge conjugation, time reversal.

Introduction to Lie algebras and groups. SU(2) and SU(3) and particle physics applications: spin, isospin, quark model.

**READING LIST**

* H. Georgi, *Lie Algebras in Particle Physics,* Westview Press, 1999.
* A. Zee, *Group Theory in a Nutshell for Physicists,* Princeton University Press, 2016.
* G. Krane, *Introductory Nuclear Physics,* Wiley, 2008.
* D. Griffiths, *Introduction to Elementary Particles,* Wiley-*VCH,* 2008.

***TEACHING METHOD***

Classroom lectures.

***ASSESSMENT METHOD AND CRITERIA***

Oral examination.

The oral exam will assess the comprehension of the subjects presented during the lectures, and will consist of an exposition of a number of topics of the course program by the student. A further discussion of them may occur.

The evaluation criteria will consist in: correctness of the answers to the examining commission’s questions, appropriateness of the methodology presented and completeness of the presentation.

***NOTES AND PREREQUISITES***

Students are supposed to have already attended the Quantum Mechanics course during the first semester.

Meetings can be arranged directly after each lecture. Additional meetings can be set up upon request.

*Further information can be found on the lecturer's webpage at http://docenti.unicatt.it/web/searchByName.do?language=ENG or on the Faculty notice board.*