Course Title :	**Nuclear Reactions and Hadronic Physics**
Number of hours/semester :	30 h, 2nd Semester
Number of ECTS :	3
Lecture outline, contents :	The Nuclear Reaction lectures present the fundamentals of the theory of non-relativistic reactions at low-energies. The aim is to educate the attendees on the basic theoretical tools used in nuclear/atomic collisions, nuclear structure, astrophysics etc... During the course, we review formal resolution methods such as partial wave decomposition and Lippmann-Schwinger equation. We present practical approximation to the scattering problem e.g. the R-matrix method, optical potential, the Born approximation and DWBA extension. The presentation concludes with a presentation of current research topics in the field. The "hadron physics" part presents an analysis of the properties of the nucleon and hadrons in terms of quarks and gluons, the objects of Quantum Chromodynamics. Three topics, illustrated by current experiments, are discussed. They are hadron spectroscopy, elastic scattering and form factors, deep inelastic scattering and parton distributions. The goal for the students is to realize that they have all the tools in hand to address the topics of current hadronic physics. The QGP part presents the studies of this deconfined and highly interacting state of the QCD matter subjected to high energy and temperature densities. Theoretical and experimental tools to address this subject are described and its results illustrated by examples. A selection of the current experiments and the main results is presented. The goal is to learn the concepts and tools available to study the properties of this QCD matter.
Pedagogical methods :	Lectures and Tutorials
Prerequisites :	
Modalities of knowledge assessment :	Written examination at the end of the semester for the first session and Oral examination for second session (for the second session, the maximum grade is limited to 10)
Bibliography :	1. Nuclear Reactions: Quantum Collision Theory C. J. Joachain, ISBN 978-0-444-86773-5, North-Holland, 1975. 2. Hadron Physics: T.W. Donnelly, J.A. Formaggio, B.R. Holstein, R.G. Milner, B. Surrow: Foundations of Nuclear and Particles Physics, 2017 3. QGP: Introduction to Relativistic Heavy Ion Collisions by L. Csernai, 2008, www.csernai.no/Csernai-textbook.pdf