Course Title :	**From Nuclei to Stars**
Number of hours/semester :	60 h, 1st Semester
Number of ECTS :	6
Lecture outline, contents :	This lecture is structured in 3 main parts: I. phenomenological approaches to nucleus (24h); II. theory for nuclear structure (24h); III. introduction to nuclear astrophysics (12h). Topics treated in the first part are: the saturation of nuclear forces, internal structure of the nucleus (shell model) and an introduction to pairing and quadrupole correlations. All the topics are illustrated through recent experiments. The second part treats the following topics: many-body quantum mechanics, symmetries in nucleon-nucleon interaction, second quantization formalism, Wick theorem and its application to the nuclear Hamiltonian, mean-field and beyond mean-field methods for the description of atomic nuclei. Introduction to nuclear astrophysics is given in the third part. Observed properties of stars, the chemical evolution of elements, and principles of stellar structure and evolution are first presented. This is followed by a description of the nucleosynthesis processes at work in the Universe from primordial to stellar synthesis of elements. Cross-section and thermonuclear reaction rates are then introduced, and an overview of key nuclear reactions is given, together with the different experimental approaches used in nuclear astrophysics.
Pedagogical methods :	Lectures and Tutorials
Prerequisites :	Quantum Mechanics
Modalities of knowledge assessment :	Written examination at mid-term and 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. Theoretical Nuclear Physics – J. Blatt, V. Weisskopf 2. The Nuclear Shell Model – K. Heyde 3. The Nuclear Many-Body Problem – P. Ring, P. Schuck 4. Nuclear Physics of Stars -- C. Iliadis