



Course unit English denomination	Nuclear Reactions with Heavy Ions
Teacher in charge (if defined)	Alberto Stefanini (LNL) – Edoardo Lanza (INFN Catania)
Teaching Hours	24
Number of ECTS credits allocated	3
Course period	February-June 2025
Course delivery method	☒ In presence ☐ Remotely ☐ Blended
Language of instruction	English
Mandatory attendance	☒ Yes (50% minimum of presence) ☐ No
Course unit contents	In the first part of the course the main features of nuclear reactions with heavy ions (elastic scattering, inelastic scattering, Coulomb excitation, break-up, transfer, deep inelastic) will be discussed, in connection with the structural properties of colliding nuclei. Special attention will be given to reactions involving weakly-bound nuclei far from stability and close to the drip lines. The second part will be devoted to few- and multi-nucleon transfer reactions between heavy ions, sub-barrier fusion processes from both experimental and theoretical points of view, and recent developments concerning the hindrance phenomenon in connection with the Pauli exclusion principle. The role of the coupling to the internal degrees of freedom of the interacting nuclei will be emphasized, as well as the features of reactions involving radioactive ion beams. Heavy-ion reactions relevant for astrophysics and related topics, will be explicitly treated. Heavy-ion detectors, spectrometers and experimental procedures presently in use in several laboratories around the world, will be described and compared in some detail in the last part of the course.
Learning goals	The student will get a detailed view of several aspects of Nuclear Reactions Dynamics and Nuclear Structure studied using Heavy-Ion beams. Experimental tools and methods will be presented and discussed. Theoretical methods and models will be presented and applied to several cases, as well as the most recent results and issues. The students will be able to interpret the data and the different properties and excitation.
Teaching methods	Frontal lessons with slides and exercises in the classroom
Course on transversal, interdisciplinary, transdisciplinary skills	☐ Yes ☒ No
Available for PhD students from other courses	☒ Yes ☐ No
Prerequisites (not mandatory)	Master Degree in Physics
Examination methods	Oral with presentation on an agreed topic
Suggested readings	Lecture notes and slides of the course
Additional	–



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