PhD course in Physics, Astrophysics, and Applied Physics - Università degli Studi di Milano
PhD cicle 40 (2024-2025)

All lectures will be given in English.

Course title	Neutrino Physics
Teacher in charge of the course	Andreazza Attilio
List of the teachers of the course *[surname/name; affiliation; e-mail]*	Vissani Francesco; Gran Sasso Science Institute; francesco.vissani@lngs.infn.it
Training objectives	Provide an overview of current research topics in neutrino astronomy: sun, supernovae, geoneutrinos, and high energy neutrinos.
Prerequisites *[please insert details and also **state whether the course has advanced contents** suitable for students with prior knowledge of the topics or is also suitable for students without prior knowledge]*	General knowledge of the Standard Model of particle physics, classical electrodynamics, basics of statistics.
Detailed course program	History of neutrinos and of weak interactions. Neutrino oscillation. Neutrino conversion in vacuum and in matter. Experimental evidences. Overview of current research topics in neutrino astronomy: sun, supernovae, geoneutrinos, high energy neutrinos. Dirac and Majorana mass. Neutrinoless double beta decay. Extensions of the standard model: a) Right handed neutrinos, sterile neutrinos, extended matter and extended higgs fields; b) Seesaw; c) Grand unified groups; d) Neutrino masses in supersymmetric theories; e) Connections with other phenomena: mu -> e gamma, proton decay, baryogenesis.
Examination modalities	The examination consists of the discussion of an essay on a research topics in neutrino physics
Preliminary schedule *[please indicate the weeks when the lectures will be given]*	September 1-13 2025