UCLouvain

lphys2223

2024

utrino physics and dark matter

5.00 credits	30.0 h	Q2

Teacher(s)	Drewes Marco ;
Language :	English > French-friendly
Place of the course	Louvain-la-Neuve
Prerequisites	Having followed LPHYS1241, LPHYS1341, LPHYS2131, LPHYS2122 et LPHYS2132 is an asset.
Main themes	The teaching unit gives an overview of experimental and observational evidence for physics beyond the Standard Model of particle physics. The focus lies on two of the most studied problems, neutrino oscillations and the dark matter, and their theoretical interpretation.
Learning outcomes	**At the end of this learning unit, the student is able to :** **a. Contribution of the teaching unit to the learning outcomes of the programme (PHYS2M and PHYS2M1)** 1.1, 1.2, 1.6, 2.1, 3.1, 3.2, 3.3, 3.4, 4.1, 7.2, 8.1, 8.2. **b. Specific learning outcomes of the teaching unit** At the end of this teaching unit, the student will be able to : 1. describe neutrino oscillations in a simple quantum mechanical model ; 2. understand the role of neutrinos in particle physics and cosmology ; 3. be familiar with the most important neutrino experiments ; 4. understand the observational evidence for dark matter ; 5. follow the standard calculation for the density of cosmological thermal relics ; 6. put different explanations for the dark matter problem into context ; 7. have an overview of experimental search for dark matter.
Evaluation methods	Oral presentation and examination.
Teaching methods	Lectures and integrative project.
Content	Neutrinos and Dark Matter are two of most elusive components in the energy budget of the universe. The course gives an introduction into theoretical and experimental studies of their role in understanding the fundamental laws of nature and how they shaped the cosmos. Specific topics include: Neutrinos an their role in the Standard Model of particle physics Neutrino oscillations (experiment) Neutrino masses (theory) Neutrinos in cosmology (theory) Evidence for the existence of dark matter (observational) Dark matter theories The search for dark matter
Bibliography	Raffelt - Stars as Laboratories for Fundamental Physics Giunti and Kim - Fundamentals of Neutrino Physics and Astrophysics. Kolb and Turner - The Early Universe. M. Drewes - The Phenomenology of Right Handed Neutrinos A. Boyarsky et al - Sterile Neutrino Dark Matter
Faculty or entity in charge	PHYS

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Learning outcomes
Master [60] in Physics	PHYS2M1	5		🔍
Master [120] in Physics	PHYS2M	5		🔍