UCLouvain

lphys2221

2025

Astrophysics and astroparticles

The version you're consulting is not final. This course description may change. The final version will be published on 1st June.

5.00 credits	30.0 h	Q2

Language :	English > French-friendly
Place of the course	Louvain-la-Neuve
Main themes	' Short overview of astronomy and its basic concepts. ' Formation and evolution of stars ; stellar collapses. ' Neutron stars, pulsars and black holes. ' Galaxies and galactic centers ; dark matter and cosmic rays. ' Binary systems and gravitational waves. ' Cosmic microwave background radiation and evolution of universe.
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)** AA1 : A1.2, A1.6 AA2 : A2.1, A2.5 AA3 : A3.1, A3.2, A3.3, A3.4 AA4 : A4.1, A4.2 AA5 : A5.1, A5.2, A5.3, A5.4 AA6 : A6.1 AA7 : A7.1, A7.3, A7.4 AA8 : A8.1 1 **b. Specific learning outcomes of the teaching unit** By the end of this teaching unit, the student will be able to : 1. applyfundamental physics laws for modeling crucial phenomena in astrophysics ; 2. explain and discussthe roles of both nuclear reactions and fundamental interactions in stellar evolution ; 3. explain and discuss the specific mechanisms behind the variety of major phenomena in astrophysics ; 4. further the study of a specific topic of modern astrophysics ; 5. relate the contents of the course to current developments in astrophysics as well as in astroparticle physics.
Evaluation methods	Individual oral exam based on scientific paper readings and discussion.
Teaching methods	Traditional lectures in class and flipped classrooms. Reading portfolio for personal study.
Content	• Fundamental notions of astronomy, units and variables, basic measurements ; star catalogues (spectra & luminosities); Hertzsprung-Russell diagram. • Star formation mechanisms; nuclear fusion and star evolution ; astrophysics of the Sun and solar neutrinos.. • Particles and radiation in the cosmos: electromagnetic emission, particle acceleration, interaction, and propagation, dark matter detection. • Galactic and extragalactic high-energy phenomena: interstellar medium and magnetic fields, accretion power, supernovae, neutron stars, white dwarfs, black holes, active galactic nuclei,... • Multi-messenger astronomy: first detected sources, theoretical implications, alert systems, real-time astronomy,...
Bibliography	• D. Perkins, *Particle Astrophysics* (Oxford master series). • M. Longair, *High Energy Astrophysics* (Cambridge University press). • M. Spurio, *The Probes of Multi-Messenger Astrophysics* (Springer, 2020).

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		🔍