UCLouvain

lphys2221

2019

Astrophysics and astroparticles

In view of the health context linked to the spread of the coronavirus, the methods of organisation and evaluation of the learning units could be adapted in different situations; these possible new methods have been - or will be - communicated by the teachers to the students.

5 credits	30.0 h	Q2

Teacher(s)	Piotrzkowski Krzysztof ;
Language :	English
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.
Aims	**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 1 AA8 : A8.1 **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. - - - - *The contribution of this Teaching Unit to the development and command of the skills and learning outcomes of the programme(s) can be accessed at the end of this sheet, in the section entitled "Programmes/courses offering this Teaching Unit".*
Evaluation methods	**Due to the COVID-19 crisis, the information in this section is particularly likely to change.** Written examination with exercises combined with an individual oral exam based on a personal project report.
Teaching methods	**Due to the COVID-19 crisis, the information in this section is particularly likely to change.** Traditional lectures in class. Integrative personal project - subject left to the student's choice. 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 ; stellar lifetimes and energy sources ; stellar equation of state, nuclear fusion and star evolution ; astrophysics of the Sun and solar neutrinos. • Astrophysics of neutron stars and pulsars ; phenomenology of the black holes. • Stellar collapses and origin of elements ; mechanisms behind the *Gamma Ray Bursts* (GRBs).

	• Characterization of galaxies and the dark matter problem ; phenomenology of the *Active Galactic Nuclei* (AGNs) ; characterization of the cosmic rays and modelling their sources. • Merging of the binary systems and multi-messenger astronomy ; sources of gravitational waves. • Origin of *Cosmic Microwave Background* (CMB) radiation and its characteristics ; studies of the early Universe.
Bibliography	• K. Lang, Essential Astrophysics (Springer, Berlin, 2013). • W. Kundt, Astrophysics: A New Approach (Springer, Berlin, 2005). • G. Sigl, Astroparticle Physics: Theory and Phenomenology (Atlantis Press, Paris, 2017).
Faculty or entity in charge	PHYS

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