UCLouvain

lphys2351

2020

Superconductivity

Due to the COVID-19 crisis, the information below is subject to change, in particular that concerning the teaching mode (presential, distance or in a comodal or hybrid format).

5 credits	22.5 h + 7.5 h	Q1

Teacher(s)	Piraux Luc ;
Language :	English
Place of the course	Louvain-la-Neuve
Main themes	The teaching unit will study superconductivity under an experimental prism and following the chronology of the major discoveries associated with superconductivity. The topics will be: theoretical description of superconductivity, features of type II superconductors , overview of main applications, macroscopic quantum phenomena in superconductors (SQUID), superconductivity at the nanoscale, labs allowing the studentto observe and become familar withsuperconductivity.
Aims	**a. Contribution of the teaching unit to the learning outcomes of the programme (PHYS2M)** AA1: A1.1, A1.3, A1.4 AA2: A2.2 AA5: A5.3 **b. Specific learning outcomes of the teaching unit** At the end of this teaching unit, the student will be able to : 1. describe the main physical phenomena related to the superconducting state ; 2. explain the physical mechanisms that govern the superconducting state ; 3. link the superconducting properties of materials (including their response to a magnetic field) with their electronic scale lengths ; 4. identify and apprehend the various fields of application of superconducting materials ; 5. cite the classes of superconducting materials by illustrating them with examples of application ; 6. identify macroscopic quantum phenomena in superconductors ; 7. understand the fundamental differences recorded in nanoscale superconducting properties ; 8. learn through laboratory sessions the experimental methods associated with the electrical and magnetic characterization of superconductors and to identify the uncertainties of the observations. 1 - - - - *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.** The students are evaluated individually, in an oral examination, on the basis of the above-mentioned learning outcomes. Lab report (small group of students)
Teaching methods	**Due to the COVID-19 crisis, the information in this section is particularly likely to change.** Ex-cathedra lectures, laboratory sessions allowing the student to observe and perform practical tasks related to the subject matter of this course. The labs provide an introduction to experimental methods (low temperature characterization of superconducting materials using electrical and magnetic measurements) and analysis of the results (critical temperature and magnetic fields, coherence length, …).
Content	1. Fundamental phenomena associated with superconductivity. 2. Overview of main applications. 3. Description of superconductivity. 4. Type II superconductors . 5. Macroscopic quantum phenomena in superconductors (phase effects). 6. Superconductivity at the nanoscale. 7. Characterization labs of superconductors at low temperature.
Bibliography	*Introduction to Superconductivity. Michael Tinkham*. Series: (International series in pure and applied physics), edition. New York McGraw-Hill. *Superconductivity*, *Superfluids and Condensates*. James F. Annett. University of Bristol. Oxford University Press. The slides presented during the lectures and lecture notes on superconductivity are available on MoodleUCL. *Introduction to Superconductivity. Michael Tinkham*. Series: (International series in pure and applied physics), edition. New York McGraw-Hill. *Superconductivity*, *Superfluids and Condensates*. James F. Annett. University of Bristol. Oxford University Press.

Faculty or entity in charge	PHYS

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Aims
Master [120] in Physical Engineering	FYAP2M	5		
Master [120] in Physics	PHYS2M	5		