

60031 - Low temperature physics and quantum technologies

Información del Plan Docente

Academic Year	2016/17
Academic center	100 - Facultad de Ciencias
Degree	538 - Master's in Physics and Physical Technologies
ECTS	5.0
Course	1
Period	Second semester
Subject Type	Optional
Module	---

1. Basic info

1.1. Recommendations to take this course

1.2. Activities and key dates for the course

2. Initiation

2.1. Learning outcomes that define the subject

2.2. Introduction

3. Context and competences

3.1. Goals

3.2. Context and meaning of the subject in the degree

3.3. Competences

3.4. Importance of learning outcomes

4. Evaluation

5. Activities and resources

5.1. General methodological presentation

Results of this course include the acquisition by the students of theoretical and experimental knowledge in the field of low-temperature physics and quantum technologies. To achieve these results, activities that promote an active and continued involvement of students in the different course topics have been programmed. The course consists of three learning activities: lectures on the contents of the course (4 ECTS); class discussion and problem solving (0.4 ECTS); laboratory work and reporting on such work (0.6 ECTS). These activities help the students in learning the different topics and give them competence in handling low temperature physical techniques and in solving problems.

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5.2.Learning activities

The program that the student is offered to help you achieve the expected results includes the following activities.

Lectures on the contents of the program detailed in Section 5.3.

Low temperatures laboratory. It includes classes on highly practical aspects such as cooling techniques, thermometry, thermal contact and insulation, etc. In addition, there will be three practical sessions

1. From room temperature to mK.
2. Use of a SQUID
3. Experiments on quantum circuits

Personal work by the student to solve questionnaires about the different contents of the subject and to discuss them with the teacher and with other students in the evaluation sessions scheduled .

5.3.Program

- I. Introduction (early evolution of low-temperature physics and its methods)
- II. Superconductivity (general concepts and theoretical models, Josephson effect and circuits based on superconducting Josephson junctions, applications of superconductivity)
- III. Quantum gases and quantum liquids (laser cooling techniques, cold atoms and trapped ions, Bose-Einstein condensates in dilute gases, superfluidity)
- IV Quantum Technologies (introduction, ions, atoms and spins as realizations of qubits, superconducting quantum circuits, light-matter interaction in a chip, decoherence and dissipation, computing and quantum information, quantum simulation).

5.4.Planning and scheduling

The final schedule of the course will be set and announced well before its start.

5.5.Bibliography and recommended resources