

26924 - Quantum Physics II

Syllabus Information

Academic year: 2023/24

Subject: 26924 - Quantum Physics II

Faculty / School: 100 - Facultad de Ciencias

Degree: 447 - Degree in Physics

ECTS: 8.0

Year: 3

Semester: Second semester

Subject type: Compulsory

Module:

1. General information

The subject explains the basic methods of Quantum Physics that are necessary to understand the structure of atoms and molecules and their interaction with electromagnetic radiation.

It is recommended to have taken Quantum Physics I.

The objectives of the subject are aligned with some Sustainable Development Goals (SDGs) of the Agenda 2030 of United Nations (<https://www.un.org/sustainabledevelopment/es/>), so that the acquisition of the learning results of the subject contributes to some extent to:

- Goal 4: Quality Education.
- Goal 12: Responsible Production and Consumption

2. Learning results

Main learning results:

1. Apply approximate methods of calculation in Quantum Physics.
2. Use the symmetry properties of a system.
3. Understand the behaviour of fermions and identical bosons.

These results are achieved with its concrete application to:

- Structure of the hydrogen atom, helium and the remaining multielectron atoms.
- Absorption and emission of electromagnetic radiation by atoms.
- Description of the dynamics of molecules.

3. Syllabus

1. Rotations. Scalar operators. Invariance under rotations.
2. Stationary disturbances. Fine structure of the hydrogen atom.
3. Identical particles.
4. Helium atom. Fundamental level. Method of variations. Excited levels.
5. Time-dependent disturbances.
6. Electromagnetic field. Electric dipolar approximation. Tensor operators. Selection rules in hydrogen.
7. Multielectron atoms. Layer model. LS coupling. Fine structure. Selection rules. Zeeman effect.
8. Molecules. H₂+molecule. Born-Oppenheimer approach. Diatomic molecules.

4. Academic activities

The course consists of 8 ECTS organized as follows:

- Theory classes: 55 hours
- Types of problems: 15 hours

- Laboratory practices: 10 hours
- Assessment tests. 3 hours
- Personal study. 117 hours

5. Assessment system

Classroom evaluation (grade A). Resolution in the classroom of the theoretical-practical exercises that are raised and that the students will solve and deliver after a pre-set time before the end of the class. In this activity they can achieve get up to 10 points.

Evaluation of laboratory reports (note L). Writing of the reports of the practical laboratory sessions (including introduction, methodology and results) and their delivery on the due dates. In this activity they can achieve get up to 10 points. Reports not submitted by the deadline will be graded with 0 points.

Completion of a theoretical-practical test on the date established in the academic calendar (grade P). It is mandatory for all students. In this activity they can achieve get up to 10 points.

Students whose L grade is lower than 5 points will also have to take a practical test in the laboratory. The final grade is the highest of

$$N1=0.1*A+0.1*L+0.8*P \text{ or } N2=0.1*L+0.9*P$$

and must be greater than or equal to 5 points to pass the subject.