Universidad Zaragoza

Academic Year/course: 2024/25

26929 - Nuclear and Particle Physics

Syllabus Information

Academic year: 2024/25
Subject: 26929 - Nuclear and Particle Physics
Faculty / School: 100 - Facultad de Ciencias
Degree: 447 - Degree in Physics
ECTS: 6.0
Year: 4
Semester: First semester
Subject type: Compulsory
Module:

1. General information

In Quantum Physics I and II, students will have acquired basic knowledge about the quantum structure of atoms and molecules. This subject is intended to take the student through the path that leads from atoms to nuclei and from these to the most elementary particles of matter, quarks and leptons.

To take this subject it is recommended to have passed Quantum Physics I and II.

2. Learning results

- Estimate size and mass of nuclei.
- Determine the nuclear instability for the different disintegration mechanisms.
- Know the validity ranges of nuclear models and apply them appropriately in simple situations.
- Relate the properties of the deuteron to nuclear forces.
- Calculate spin, parity and magnetic moment in the extreme layered model.
- Identify/classify the type of fundamental interactions according to their cross-sections or decay widths
- Correct handling of radioactive isotope and particle tables.
- Measure a beta spectrum and calculate the Kurie diagram.
- Apply relativistic and non-relativistic kinematics to reactions and disintegrations of nuclei and particles.
- Know the most important processes of fusion in stars and fission in nuclear power plants.

3. Syllabus

Nuclear Physics

- General properties of the nuclei.
- Nuclear forces.
- Nuclear disintegrations: alpha, beta, gamma and nuclear fission.
- Nuclear models.
- Nuclear reactions.
- Nuclear fusion.

Particle Physics

- Historical introduction
- Leptons
- Hadrons
- Quark model
- Quantum Chromodynamics
- Electroweak unification
- Standard Model

4. Academic activities

The subject includes 6 ECTS organized as follows:

- Theory classes (4 ECTS): 40 hours
- Problem classes (1.5 ECTS): 15 hours
- Laboratory practices (0.5 ECTS): 5 hours

The theoretical classes will serve to introduce students to the basic knowledge required to solve the problems and perform the work in the laboratory. Problem solving and laboratory sessions will be appropriately interspersed throughout the term.

The theoretical-practical evaluation test will take place on the date established by the center and will last approximately 3 hours.

The practical laboratory test for those students who have not handed in the laboratory report within the deadline will take place during the official exam period set by the center on a date to be established by the teacher.

5. Assessment system

The subject will be evaluated as follows:

- Classroom evaluation (**grade A**). Resolution in the classroom of the theoretical-practical questions and exercises that are posed and that the students will solve and deliver after a pre-set time before the end of the class.
- Evaluation of laboratory reports (**grade L**). Students must submit a written report of the work done in the laboratory at least fifteen school days before the date of the theoretical-practical test.
- Completion of a theoretical-practical test on a date pre-established by the center (**grade P**). Students who have not submitted the lab report on time will also take a practical lab test which will be their L grade.

Each activity is evaluated up to 10 points and the final grade is the highest of

N=0.2***A**+0.1***L**+0.7***P**

N=0.1***L**+0.9***P**

N=0.2***A**+0.8***P**

N=**P**

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

The **A** and **L** grades will also be kept for the second call.

Passing the subject by means of a single global test:

Alternatively, students may pass the subject by means of a single global test which will be the theoretical-practical test on a date pre-established by the center.

6. Sustainable Development Goals

4 - Quality Education