Nuclear and high energy physics - course description

General information

Course name	Nuclear and high energy physics
Course ID	13.2-WF-FizD-NHEP-S17
Faculty	Faculty of Physics and Astronomy
Field of study	Physics
Education profile	academic
Level of studies	Second-cycle studies leading to MS degree
Beginning semester	winter term 2021/2022

Course information

Semester	3
ECTS credits to win	6
Course type	obligatory
Teaching language	english
Author of syllabus	• prof. dr hab. Piotr Rozmej

Classes forms

The class form	Hours per semester (full-time)	Hours per week (full-time)	Hours per semester (part-time)	Hours per week (part-time)	Form of assignment
Lecture	30	2	-	-	Exam
Class	30	2	-	-	Credit with grade

Aim of the course

Introduction to fundamentals of nuclear physics and high energy physics.

Prerequisites

Basic knowledge of classical and quantum mechanics.

Scope

Lecture:

- Subjects of nuclear physics and high energy physics

- Physical quantities characterizing nuclei and elementary particles; mass, charge, life-time, barion and lepton numbers, spin, magnetic moment, isospin, parity.

- Nucleon-nucleon interaction. Theory of deuteron.

- Nuclear models: Liquid Drop Model, Fermi gas model, shell model, self-consistent model.

- Mean field theory. Nuclear potentials.

- Residual interactions, quasi-spin model, BCS theory.

- Collective motion. Rotational and vibrational excitations.

- Spontaneous decay of nuclei; α, β, γ, fission.

- Nuclear reactions, Collisions with low, medium and high energies.

- Elements of the standard model and high energy physics.

Classes: The scope of the classes is basically the same as the lecture. Detailed calculations of some examples.

Teaching methods

Lectures on problems and discussions. During the classes, students solve tasks and recalculate some theoretical examples.

Learning outcomes and methods of theirs verification

Outcome description	Outcome symbols	Methods of verification	The class form
The student understands several models applicable in nuclear physics: liquid drop model, Fermi gas model. The student is able to estimate basic nuclear propertis on the ground of those models	• K2_U03	• a quiz • an exam - oral, descriptive, test and other • an oral response	• Lecture • Class

Outcome description	Outcome symbols	Methods of verification	The class form
The student knows general mechanisms of nuclear reactions	• K2_U03	• an exam - oral, descriptive, test and other • an oral response	• Lecture • Class
The student knows and understands the fundamental properties of atomic nuclei.	• K2_W01 • K2_U01	• an exam - oral, descriptive, test and other • an oral response	• Lecture • Class

Assignment conditions

A course credit for the lectures is obtained by taking a final exam composed of tasks of varying degrees of difficulty.

During the classes the preparation of the students will be checked as well as their understanding of the lecture content at the time of the lectures. To obtain a course credit for the exercises 50% of the maximum number of points will be required, which can be achieved through two cumulative tests. A student who achieves at least 10% of the maximum points and who does not exceed the class absence limit has the right to a resit test of the entire material before the examination date. The result of the exam is also affected by class participation and preparation for the class.

Recommended reading

[1] P. Rozmej*, Lecture Notes,* plik pdf.

[2] B. Nerlo-Pomorska, K. Pomorski, *Zarys teorii jądra atomowego,* PWN, Warszawa 1999.

Further reading

[1] E. Skrzypczak, Z. Szefliński, *Wstęp do fizyki jądra atomowego i cząstek elementarnych*, PWN, Warszawa 1995.

[2] W. S. C. Williams, *Nuclear and particle physics*, Oxford: Clarendon Press, 1997.

Notes

Modified by dr Marcin Kośmider (last modification: 09-05-2021 21:41)