Course Unit Descriptor

Study Programme: PhD Studies in Physics

Course Unit Title: Basic interactions and structure of atomic nuclei

Course Unit Code: FD18OISJ

Name of Lecturer(s): Full Professor Istvan Bikit

Type and Level of Studies: PhD Degree

Course Status (compulsory/elective): Elective

Semester (winter/summer): Winter

Language of instruction: English

Mode of course unit delivery (face-to-face/distance learning): Face-to-face

Number of ECTS Allocated: 30

Prerequisites: Fundamentals of Nuclear Physics, Nuclear Physics

Course Aims:

Gaining knowledge of basic interactions and the structure of atomic nuclei.

Learning Outcomes:

Students should develop:

- Basic abilities: become familiar with the theoretical principles of nuclear physics.
- Specific abilities:since some technologies are studied in detail, the knowledge could be applied for practical purpose.

Syllabus:

Theory

Nucleon. Quarks. Mass and binding energy. The shape and dimensions. Electromagnetic moments. Statistics. Strong interaction - nuclear force. The nature of nuclear forces. Nucleon - nucleon interaction. Exchange forces. Meson theory of nuclear forces. The classical theory of weak interactions and nuclear beta decay. Fermi and Gamow-Teller transitions. Allowed and forbidden transitions-selection rules. Parity nonconservation and V - A structure of weak interactions. Limits (boundaries) of the classical theory. Multipolarization and quantization of the nuclear electromagnetic field. Angular distribution of radiation. Transition probabilities in single-particle model. Angular correlation and polarization. Models of the nucleus. Deformed nuclei and collective motion. Alpha decay. Fission and thermonuclear fusion. Gamma emissions. The transition probabilities. Resonant absorption of electromagnetic radiation. Nuclear reactions. Elastic and inelastic scattering. Reactions through the compound nucleus. Direct reactions.

Practice

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Required Reading:

1. D. Jelley: Fundamentals of nuclear physics, Cambrige University Press, Cambridge, 1990.
2. W. Burcham, M. Jobes: Nuclear and Particle Physics, Congman, Harlow, 1995.
3. P. Marmier, E. Sheldon: Physics of Nuclei and Particles, Acad. Press, New York, 1969.
4. Herwig F. Schopper Weak Interactions and Nuclear Beta Decay, North Holland Publishing Company, 1966.
5. Barry R. Holstein Weak Interactions in Nuclei, Prinston University Press, 1989.
6. K. Grotz and H. V. Klapdor weak Interaction and Nuclear Particle and Astrophysics , Adam Hilger, 1990.

Weekly Contact Hours:	**Lectures:**	**Practical work:**

Teaching Methods: Lectures and seminars.			
Knowledge Assessment (maximum of 100 points):			
Pre-exam obligations	points	**Final exam**	points
Active class participation	5	written exam	
Practical work	10	oral exam	70
Preliminary exam(s)		…….	
Seminar(s)	15		
The methods of knowledge assessment may differ; the table presents only some of the options: written exam, oral exam, project presentation, seminars, etc.			