

Module title		Abbreviation
Nuclear and Elementary Particle Physics		11-E-T-152-m01
Module coordinator		Module offered by
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
6	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	undergraduate	--
Contents		
<ol style="list-style-type: none"> 1. Overview, historical introduction, history and significance of Nuclear and Particle Physics 2. Methods of Nuclear Physics, scattering and spectroscopy, nuclear radius, composition of matter, mass and charge distribution in the nucleus, the discovery of the proton and neutron 3. Nuclear models, the mass of the atomic nuclei, droplet model, bonding energy, nuclear shell model 4. Structure of cores, angular momentum, spin, parity, mag. and electr. moments, collective excitation forms, spin-orbit interaction 5. Radioactivity and spectroscopy, radioactive decay, natural and civilisational sources of ionising radiation 6. Nuclear energy, nuclear fission, nuclear reactors, nuclear fusion, star power, star development, formation of the chemical elements of hydrogen 7. Radiation and matter, interaction of radiation and matter, Bethe-Bloch formula, photoelectric effect, pair production 8. Instruments, accelerators and detectors 9. Electromagnetic interaction, differential cross section, virtual photons, Feynman graphs, exchange interaction 10. Strong interaction, quarks, gluons, colour and degree of freedom, deep-inelastic electron-proton scattering, confinement, asymptotic freedom, particle zoo, isospin, strangeness, SU (3) symmetry, antiprotons 11. Weak interaction, cracked mirror symmetries, Wu experiment, charge conjugation, time reversal, CP invariance, exchange particles, W and Z, neutrinos, neutrino vibrations 12. Standard model, three families of leptons and quarks, quark-lepton symmetry, Higgs boson, free parameters 		
Intended learning outcomes		
The students understand the basic connections between fundamental Nuclear and Elementary Particle Physics. They have an overview of the experimental observations of Particle Physics and the theoretical models which describe them.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3) + Ü (1) Module taught in: Ü: German or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)		
written examination (approx. 120 minutes) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Bachelor' degree (1 major) Mathematics (2015) Bachelor' degree (1 major) Physics (2015) Bachelor' degree (1 major) Mathematical Physics (2015)		

Bachelor' degree (1 major) Computational Mathematics (2015)
Bachelor's degree (1 major, 1 minor) Physics (Minor, 2015)
Bachelor' degree (1 major) Mathematical Physics (2016)
Bachelor' degree (1 major) Physics (2020)
Bachelor' degree (1 major) Mathematical Physics (2020)
Bachelor's degree (1 major, 1 minor) Physics (Minor, 2020)