

Module title		Abbreviation
Electrodynamics		11-T-E-152-m01
Module coordinator		Module offered by
Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
8	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	undergraduate	--
Contents		
<p>0. Mathematical tools: Gradient, divergence, curl; curve, surface, volume integrals; Stokes and Gaussian sentence; Delta function; Fourier transform; full functional systems; solving PDEs;</p> <p>1. Maxwell equations;</p> <p>2. Electrostatics: Coulomb's law; electrostatic potential; charged interface; electrostatic field energy (capacitor); multipole expansion; Boundary value problems; numerical solution; Image charges; Green's functions; development according to orthogonal functions;</p> <p>3. Magnetostatics: Current density; continuity equation; vector potential; Biot-Savart law; magnetic moment; analogies to electrostatics;</p> <p>4. Maxwell equations in matter: Electrical and magnetic susceptibility; interfaces;</p> <p>5. Dynamics of electromagnetic fields: Faraday induction; RCL-circuits; field energy and pulse; potentials; plane waves; wave packets; plane waves in matter; cavity resonators and wave guides; inhomogeneous wave equation; temporally oscillating sources and dipole radiation; accelerated point charges;</p> <p>6. Special Theory of Relativity: Lorentz transform; simultaneity; length contraction and time dilation; light cone; effect, energy and momentum; co- and contra-variant tensors; covariant classical mechanics;</p> <p>7. Covariant electrodynamics: Field strength tensor and Maxwell's equations; transformation of the fields; Doppler effect; Lorentz force</p>		
Intended learning outcomes		
The students have advanced knowledge of the methods of Theoretical Physics. They know the principles of theoretical electrodynamics. They are familiar with the corresponding mathematical methods and are able to independently apply them to the description and solution of problems in this area.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2) 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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Workload		
240 h		
Teaching cycle		
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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) Nanostructure Technology (2015)
Bachelor' degree (1 major) Computational Mathematics (2015)
Bachelor's degree (1 major, 1 minor) Physics (Minor, 2015)
Bachelor' degree (1 major) Nanostructure Technology (2020)
Bachelor's degree (1 major, 1 minor) Physics (Minor, 2020)
Bachelor' degree (1 major) Quantum Technology (2021)
Bachelor' degree (1 major) Mathematics (2023)
exchange program Physics (2023)