

<b>Module title</b>		<b>Abbreviation</b>
Electrodynamics		11-T-E-152-m01
<b>Module coordinator</b>		<b>Module offered by</b>
Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
8	numerical grade	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	--
<b>Contents</b>		
<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>		
<b>Intended learning outcomes</b>		
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.		
<b>Courses</b> (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2) Module taught in: Ü: German or English		
<b>Method of assessment</b> (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		
<b>Allocation of places</b>		
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<b>Additional information</b>		
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<b>Workload</b>		
240 h		
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
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<b>Module appears in</b>		
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)