Module title				Abbreviation
Mathematics 4 for Students of Physics and related Disciplines (Complex Analysis)				11-M-F-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

Basic knowledge of functional analysis that is required in the course Quantum Mechanics I. The definition of Hilbert space opens up understanding of quantum mechanical states as vectors. The representation-free form of quantum mechanics and the representation as a wave function generated by basic states form an important element of the formal framework of quantum mechanics with the so-called bracket formalism by Dirac.
Fundamentals of partial differential equations in physics and systems of differential equations.

Part I: functional analysis
1.1 Linear vector spaces
1.2 Metric, standardized spaces
1.3 Linear operators
1.4 Function space, completion, Lebesgue integral, Hilbert space
1.5 Linear operators on the Hilbert space
1.6 Matrix representation of operators
1.8 The Dirac delta function and its different representations

Part II: differential equations
2. Partial differential equations
2.1 Linear partial differential equations of 2nd order
2.2 1D and 3D wave equation
2.3 Helmholtz equation and potential theory
2.4 Parabolic differential equations

Intended learning outcomes

The student has basic knowledge of mathematics and basic knowledge of Hilbert space mathematics, as well as knowledge of solution methods for partial differential equations and is proficient in the necessary computing techniques.

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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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in
Bachelor' degree (1 major) Physics (2015)
Bachelor' degree (1 major) Nanostructure Technology (2015)
Bachelor' degree (1 major) Physics (2020)
Bachelor' degree (1 major) Nanostructure Technology (2020)