

Module No.:

physics605

Credit Points (CP):

7

Category:

Required

Semester:

7.



Module: Base Module Theoretical Physics

Module Elements:

Nr.	Course Title	Number	CP	Type	Workload	Sem.
1.	Advanced Quantum Theory	physics606	7	Lect. + ex.	210 hrs	WT
2.	Advanced Theoretical Physics	physics607	7	Lect. + ex.	210 hrs	WT

Requirements:

Preparation:

Content:

The course provides fundamental knowledge needed for theoretical lectures in the Master course

Aims/Skills:

The M.Sc. Physics programme includes one obligatory module for all students. It includes a theoretical unit to extend the B.Sc. in Physics knowledge

Form of Testing and Examination:

Requirements for the module examination (written examination): successful work with exercises

Length of Module: 1 semester

Maximum Number of Participants: ca. 100

Registration Procedure:

s. <https://basis.uni-bonn.de> u. <http://bamawww.physik.uni-bonn.de>

Note: When the student has (upon admission) demonstrated satisfactory knowledge of Advanced Quantum Theory already, the class Advanced Theoretical Physics may be taken instead

Module: Base Module Theoretical Physics

Module No.: physics605

Course:  **Advanced Quantum Theory**

Course No.: physics606

Category	Type	Language	Teaching hours	CP	Semester
Required	Lecture with exercises	English	3+2	7	WT

Requirements:**Preparation:**

Theoretical courses at the Bachelor degree level

Form of Testing and Examination:

Requirements for the module examination (written examination): successful work with exercises

Length of Course:

1 semester

Aims of the Course:

Ability to solve problems in relativistic quantum mechanics, scattering theory and many-particle theory

Contents of the Course:

Born approximation, partial waves, resonances
 advanced scattering theory: S-matrix, Lippman-Schwinger equation
 relativistic wave equations: Klein-Gordon equation, Dirac equation
 representations of the Lorentz group
 many body theory
 second quantization
 basics of quantum field theory
 path integral formalism
 Greens functions, propagator theory

Recommended Literature:

L. D. Landau, E.M. Lifschitz; Course of Theoretical Physics Vol.3 Quantum Mechanics (Butterworth-Heinemann 1997)
 J. J. Sakurai, Modern Quantum Mechanics (Addison-Wesley 1995)
 F. Schwabl, Advanced Quantum Mechanics. (Springer, Heidelberg 3rd Ed. 2005)

Module: Base Module Theoretical Physics

Module No.: physics605

Course: universität  Advanced Theoretical Physics

Course No.: physics607

Category	Type	Language	Teaching hours	CP	Semester
Elective	Lecture with exercises	English	3+2	7	WT

Requirements:**Preparation:**

3-year theoretical physics course with extended interest in theoretical physics and mathematics

Form of Testing and Examination:

Requirements for the module examination (written examination): successful work with exercises

Length of Course:

1 semester

Aims of the Course:

Introduction to modern methods and developments in Theoretical Physics in regard to current research

Contents of the Course:

Selected Topics in Modern Theoretical Physics for example:

Anomalies

Solitons and Instantons

Quantum Fluids

Bosonization

Renormalization Group

Bethe Ansatz

Elementary Supersymmetry

Gauge Theories and Differential Forms

Applications of Group Theory

Recommended Literature:

M. Nakahara; Geometry, Topology and Physics (Institute of Physics Publishing, London 2nd Ed. 2003)

R. Rajaraman; Solitons and Instantons, An Introduction to Solitons and Instantons in Quantum Field Theory (North Holland Personal Library, Amsterdam 3rd reprint 2003)

A. M. Tsvelik; Quantum Field Theory in Condensed Matter Physics (Cambridge University Press 2nd Ed. 2003)

A. Zee; Quantum Field Theory in a Nutshell (Princeton University Press 2003)