

Module No.:
Credit Points (CP):
Category:
Semester:

physics605
7
Required
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:  universität**bonn****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 **bonn**

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)