Base Module Theoretical Physics - physics605

Module No.	**physics605**
Category	Required
Credit Points (CP)	7
Semester	7.

Module: Base Module Theoretical Physics

Module Elements:

Nr	Course	Course No.	CP	Type	Teaching hours	Semester
1	Advanced Quantum Theory	physics606	7	Lect. + ex.	3+2	WT
2	Advanced Theoretical Physics	physics607	7	Lect. + ex.	3+2	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: Note: When the student has (upon admission) demonstrated satisfactory knowledge of Advanced Quantum Theory already, the class Advanced Theoretical Physics may be taken instead

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Advanced Quantum Theory - physics606

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)

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Advanced Theoretical Physics - physics607

Course	**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)

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