Module No.: Credit Points (CP): Category: Semester: physics62c 7 Elective 2.



Module: Specialization: Advanced Theoretical Physics

Module Elements:

Nr.	Course Title	Number	СР	Туре	Workload	Sem.		
Theoretical Physics								
1.	Advanced Theoretical Particle Physics	physics636	7	Lect. + ex.	210 hrs	ST		
2.	Advanced Theoretical Hadron Physics	physics637	7	Lect. + ex.	210 hrs	ST		
3.	Advanced Theoretical Condensed	physics638	7	Lect. + ex.	210 hrs	ST		
	Matter Physics							

Requirements for Participation:

Form of Examination:

see with the course

Content:

Fundamentals on an advanced level in theoretical physics in Bonn or Cologne

Aims/Skills:

The students will get acquainted with modern research topics

Course achievement/Criteria for awarding cp's: see with the course

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: The student must achieve at least 24 CP out of all 6 Specialization Modules

Module:

Specialization: Advanced

Theoretical Physics

Module No.: physics62c

Course:



Advanced Theoretical Particle Physics

Course No.: physics636

Category	Туре	Language	Teaching hours	СР	Semester
Elective	Lecture with exercises	English	3+2	7	ST

Requirements for Participation:

Preparation:

Theoretical Particle Physics (physics615)

Form of Testing and Examination:

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

Length of Course:

1 semester

Aims of the Course:

Survey of methods of theoretical high energy physics beyond the standard model, in particular supersymmetry and extra dimensions in regard to current research

Contents of the Course:

Introduction to supersymmetry and supergravity, Supersymmetric extension of the electroweak standard model, Supersymmetric grand unification, Theories of higher dimensional space-time, Unification in extra dimensions

Recommended Literature:

J. Wess; J. Bagger; Supersymmetry and supergravity (Princeton University Press 1992)

H. P. Nilles, Supersymmetry, Supergravity and Particle Physics, Physics Reports 110 C (1984) 1

D. Bailin; A. Love; Supersymmetric Gauge Field Theory and String Theory (IOP Publishing Ltd. 1994)

M. F. Sohnius; Introducing supersymmtry, (Phys.Res. 128 C (1985) 39)

P. Freund; Introduction to Supersymmetry (Cambridge University Press 1995)

Module:

Specialization: Advanced

Theoretical Physics

Module No.: physics62c

Course:



Advanced Theoretical Hadron Physics

Course No.: physics637

Category	Туре	Language	Teaching hours	СР	Semester
Elective	Lecture with exercises	English	3+2	7	ST

Requirements for Participation:

Preparation:

physics616 (Theoretical Hadron Physics)

Form of Testing and Examination:

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

Length of Course:

1 semester

Aims of the Course:

Survey of methods of theoretical hadron physics in regard to current research

Contents of the Course:

Quantum Chromodynamics: Nonperturbative Results, Confinement Lattice Gauge Theory Chiral Perturbation Theory Effective Field Theory for Heavy Quarks

Recommended Literature:

F. E. Close; An Introduction Quarks and Partons (Academic Press 1980)

F. Donoghue, E. Golowich, B. R. Holstein, Dynamics of the Standard Model (Cambridge University Press 1994)

C. Itzykson, J.-B. Zuber; Quantum Field Theory (Dover Publications 2006)

A. V. Manohar, M. B. Wise; Heavy Quark Physics (Cambridge University Press 2000)

S. Weinberg; The Quantum Theory of Fields (Cambridge University Press 1995)

Module:

Specialization: Advanced Theoretical Physics

Module No.: physics62c





Advanced Theoretical Condensed Matter Physics

Course No.: physics638

Category	Туре	Language	Teaching hours	СР	Semester
Elective	Lecture with exercises	English	3+2	7	ST

Requirements for Participation:

Preparation:

physics617 (Theoretical Condensed Matter Physics)

Form of Testing and Examination:

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

Length of Course:

1 semester

Aims of the Course:

Survey of methods of theoretical condensed matter physics and their application to prominent examples in regard to current research

Contents of the Course:

Bosonic systems: Bose-Einstein condensation Photonics

Quantum dynamics of many-electrons systems: Feynman diagram technique for many-particle systems at finite temperature Quantum magnetism, Kondo effect, Renormalization group techniques Disordered systems: Electrons in a random potential Superconductivity

Recommended Literature:

A. A. Abrikosov, L.P. Gorkov; Methods of Quantum Field Theory in Statistical Physics (Dover, New York 1977)

W. Nolting; Grundkurs Theoretische Physik Band 7: Vielteilchentheorie (Springer, Heidelberg 2002)

A. C. Hewson, The Kondo Problem to Heavy Fermions (Cambridge University Press, 1997)

C. Itzykson, J.-M. Drouffe; Statistical Field Theory (Cambridge University Press 1991)

J. R. Schrieffer; Theory of Superconductivity (Benjamin/Cummings, Reading/Mass, 1983)