

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

physics62c
 7
 Elective
 2.



Module: Specialization: Advanced Theoretical Physics

Module Elements:

Nr.	Course Title	Number	CP	Type	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 Matter Physics	physics638	7	Lect. + ex.	210 hrs	ST

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
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Module No.: physics62c

Course:	 universität bonn	Advanced Theoretical Particle Physics
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Course No.: physics636

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

Requirements for Participation:
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Preparation:

Theoretical Particle Physics (physics615)

Form of Testing and Examination:

Requirements for the examination (written): successful work with the
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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 supersymmetry, (Phys.Res. 128 C (1985) 39)
 P. Freund; Introduction to Supersymmetry (Cambridge University Press 1995)

Module:	Specialization: Advanced Theoretical Physics
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Module No.: physics62c

Course:	 universität bonn	Advanced Theoretical Hadron Physics
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Course No.: physics637

Category	Type	Language	Teaching hours	CP	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
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Module No.: physics62c

Course:	 universität bonn i	Advanced Theoretical Condensed Matter Physics
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Course No.: physics638

Category	Type	Language	Teaching hours	CP	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)