

Module description

Modul	e title		Abbreviation	Abbreviation		
Theory of Superconductivity				11-TSL-161-m01		
Module coordinator				Module offered by		
Managing Director of the Institute of Theoretical Physics and Astrophysics				Faculty of Physics and Astronomy		
ECTS	Meth	od of grading	Only after succ. co	Only after succ. compl. of module(s)		
6	nume	erical grade				
Duration		Module level	Other prerequisite	Other prerequisites		
1 semester		graduate				
Conter	nts		•			
for sup	erconc ctors. E	luctivity. Review of BCS extension of the phenor	S theory and critical dis menological Ginzburg-	nventional superconductivity. Empirical Matth cussion of its applicability for different types andau theory to a quantum field theory using d response functions. Goldstone modes, phas	of super g Feyn-	

tuations, and coupling to the electromagnetic field. Interpretation of the Meissner effect using the Higgs mechanism. Interplay of magnetism and conventional/unconventional superconductivity. Discussion of current research topics and perspective on room-temperature superconductivity.

Intended learning outcomes

This lecture focuses on the understanding of unconventional superconductivity and the interactions with magnetism in the current research context. The first part of the lecture addresses conventional molecular field theory of superconductivity (BCS theory), which fails when applied to new material classes such as high-temperature superconductors. Subsequently, it introduces tools of quantum field theory necessary to expand BCS theory. Thereby it especially focuses on Meissner effect and Higgs mechanism. The last part of the lecture discusses current developments concerning the description and analysis of (un)conventional superconductors and their fascinating connection to competing magnetic phases.

Courses (type, number of weekly contact hours, language — if other than German)

V(3) + R(1)

Module taught in: German or English

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 90 to 120 minutes) or oral examination of one candidate each (approx. 30 minutes) or oral examination in groups (groups of 2, approx. 30 minutes per candidate) or project report (approx. 8 to 10 pages) or presentation/talk (approx. 30 minutes).

If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest.

Assessment offered: In the semester in which the course is offered and in the subsequent semester Language of assessment: German and/or English

Allocation of places

Additional information

Workload

180 h

Teaching cycle



Module description

Referred to in LPO I (examination regulations for teaching-degree programmes)

Module appears in

Master's degree (1 major) Mathematics (2016)

Master's degree (1 major) Physics (2016)

Master's degree (1 major) Mathematical Physics (2016)

Master's degree (1 major) Computational Mathematics (2016)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)

Master's degree (1 major) Computational Mathematics (2019)

Master's degree (1 major) Mathematics (2019)

JMU Würzburg • generated 20.10.2023 • Module data record 123907