

Module title		Abbreviation
Renormalization Group Methods in Field Theory		11-RMFT-161-m01
Module coordinator		Module offered by
Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
8	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>This course is complementary to the discussion of Wilson's renormalisation group (RG) as covered in the course "Renormalisation Group and Critical Phenomena" (11-CRP). It focuses on the diagrammatic formulation of RG flow equations and its relation to diagrammatic perturbation expansions. This is of particular relevance for interacting fermion systems in the context of functional renormalisation groups. An outline of the course might be:</p> <ol style="list-style-type: none"> <li>1. Wilson's RG</li> <li>2. Path integrals of interacting fermions</li> <li>3. Bethe-Salpeter equation</li> <li>4. RG flow equations for the one-particle and two-particle vertex</li> <li>5. Comparison of flow equations with diagrammatic resummation schemes (such as the random phase approximation)</li> <li>6. RG flow equations for spin systems.</li> </ol>		
Intended learning outcomes		
The students become familiar with the modern diagram-based description of many-particle systems. This knowledge serves as a theoretical basis for the examination of phenomena such as superconductivity, charge and spin density waves, and nematic instabilities.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + R (2) 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)		
<p>a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes).</p> <p>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.</p> <p>Assessment offered: In the semester in which the course is offered and in the subsequent semester</p> <p>Language of assessment: German and/or English</p>		
Allocation of places		
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Additional information		
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Workload		
240 h		
Teaching cycle		
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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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**Module appears in**

Master's degree (1 major) Physics (2016)  
 Master's degree (1 major) Mathematical Physics (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) Physics (2020)  
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)  
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)  
 Master's degree (1 major) Mathematical Physics (2020)  
 Master's degree (1 major) Mathematical Physics (2022)  
 exchange program Physics (2023)