Module title
Renormalization Group Methods in Field Theory

Abbreviation
11-RMFT-Int-201-m01

Module coordinator
Managing Director of the Institute of Theoretical Physics and Astrophysics

Module offered by
Faculty of Physics and Astronomy

ECTS
8

Method of grading
numerical grade

Only after succ. compl. of module(s)
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Duration
1 semester

Module level
graduate

Other prerequisites
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Contents
This course is complementary to the discussion of Wilson’s renormalization group (RG) as covered in the course „Renormalization Group and Critical Phenomena“ (11-CRP). This course focuses on the diagrammatic formulation of RG flow equations and its relation to diagrammatic perturbation expansions. For interacting fermion systems, this is of particular relevance in the context of the functional renormalization group. A possible outline of the course is:
1. Wilson’s RG
2. Path integral formulation of interacting fermions
3. Bethe-Salpeter-equation
4. RG flow equations for the one-particle and the two-particle vertex
5. Comparison of flow equations with diagrammatic resummation schemes (such as the “random phase approximation”)
6. RG flow equations for spin systems

Intended learning outcomes
Familiarity with modern diagram based techniques for interacting many-body systems. In-depth understanding of the theoretical framework addressing a range of phenomena in correlated electron systems including superconductivity, charge and spin density waves, and nematic instabilities.

Courses
V (4) + R (2)
Module taught in: English

Method of assessment
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).
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.
Language of assessment: English
Assessment offered: Once a year as announced

Allocation of places
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Additional information
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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 International (2020)