## Module title
Disordered Systems

## Abbreviation
11-UGS-131-m01

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

## Module offered by
Faculty of Physics and Astronomy

## ECTS
4

## Method of grading
numerical grade

## Only after succ. compl. of module(s)
--

## Duration
1 semester

## Module level
graduate

## Other prerequisites
Certain prerequisites must be met to qualify for admission to assessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be considered a declaration of will to seek admission to assessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for assessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent semesters.

## Contents

### Part 1
Part 1 discusses systems of interacting electrons with random potentials or random interactions with the help of quantum statistical methods which are introduced in a separate lesson. The students learn to calculate transport properties, magnetic instabilities and phase transitions as well as competing orders.

### Part II
Part II covers non-linear partial differential equations, which also describe systems far beyond equilibrium and systems with random inhomogeneity. Where applicable, exact solubility in a space dimension will be covered; otherwise and in more than one space dimension, diagram methods and renormalisation groups are applied, which will be introduced separately. As a methodological development of the methods of the course Mathematics 3, the path integral method is derived for classical and quantum mechanical models and differential equations (e.g. Feynman-Kac method).

## Intended learning outcomes

The students acquire insights into the calculability of the behaviour of physical and non-physical models with random parameters. They learn to construct diagram developments for specific models, both for Hamiltonian systems and non-equilibrium differential equations. They understand why physical laws describing the behaviour of non-ordered systems are often times simpler and how a new order arises from disorder. They learn to differentiate between quantum mechanical uncertainty and random uncertainty as well as between disorder and chaos.

## Courses

<table>
<thead>
<tr>
<th>Type</th>
<th>Number of weekly contact hours</th>
<th>Language</th>
</tr>
</thead>
<tbody>
<tr>
<td>V + R</td>
<td></td>
<td>—</td>
</tr>
</tbody>
</table>

## Method of assessment

- a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)
- Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.
- Language of assessment: German, English

## Allocation of places

--

## Additional information

--

## Referred to in LPO 1
(examination regulations for teaching-degree programmes)

--
<table>
<thead>
<tr>
<th>Module appears in</th>
</tr>
</thead>
<tbody>
<tr>
<td>Master’s degree (1 major) Physics (2010)</td>
</tr>
<tr>
<td>Master’s degree (1 major) Physics (2011)</td>
</tr>
<tr>
<td>Master’s degree (1 major) FOKUS Physics (2010)</td>
</tr>
<tr>
<td>Master’s degree (1 major) FOKUS Physics (2011)</td>
</tr>
</tbody>
</table>