**Module title**  
Bosonisation and Interactions in One Dimension

**Abbreviation**  
11-BWW-161-m01

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

**Module offered by**  
Faculty of Physics and Astronomy

<table>
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<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
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<tr>
<td>6</td>
<td>numerical grade</td>
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**Duration**  
1 semester

**Module level**  
graduate

**Other prerequisites**  
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**Contents**

1. Instability of Fermi systems in one dimension (1D)
2. Abelian bosonisation and Luttinger liquids (spinless fermions, correlation functions, models with spin, renormalization group, and the sine-Gordon model).

The below mentioned topics will be presented in different years:
3. Interacting fermions on a lattice (Hubbard model, t/J model, transport properties)
4. Bethe ansatz
5. Spin-1/2 chains
6. Disordered systems
7. Non-abelian bosonisation and the WZW model (Kac-Moody algebras, Sugawara construction, Knizhnik-Zamolodchikov equation, applications of the WZW model)

**Intended learning outcomes**

The students become familiar with the peculiarities of one-dimensional (1D) electron systems and acquire the theoretical tools to understand phenomena relevant to experiments, including disorder effects and transport in 1D.

**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**  
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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) Mathematics (2016)
Master's degree (1 major) Physics (2016)
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<th>Degree/Course</th>
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<tr>
<td>Master's degree (1 major) Mathematical Physics (2016)</td>
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<tr>
<td>Master's degree (1 major) Computational Mathematics (2016)</td>
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<tr>
<td>Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)</td>
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<tr>
<td>Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)</td>
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<tr>
<td>Master's degree (1 major) Computational Mathematics (2019)</td>
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<td>Master's degree (1 major) Mathematics (2019)</td>
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<td>Master's degree (1 major) Physics (2020)</td>
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