Module title | Magnetism and Spin Fluids
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Abbreviation | 11-MSF-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>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
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<tbody>
<tr>
<td>6</td>
<td>numerical grade</td>
<td>1 semester</td>
<td>graduate</td>
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Contents

The contents of the course vary from year to year and include topics such as spin-wave theory, spin-chains, spin ladders and spin liquids with topological orders. Depending on the lecturer, the focus may lie on magnetically ordered systems or on spin liquids.

Possible topics are:
2. Magnetic order (Holstein-Primakoff bosons and spin-wave theory)
3. Valence bond solids in spin chains (Majumdar-Gosh and AKLT Models, spinon confinement and the Haldane gap)
4. Critical spin-1/2 chains (spinon excitations in the Haldane-Shastry model, holon excitations in the Kura moto-Yokohama model)
5. Coupled spin chains and ladders
6. Chiral spin liquids (Abelian and possibly non-Abelian)
7. Kitaev’s toric code model (spinon and vison excitations)

Intended learning outcomes

The students develop an understanding of the electronic origins of magnetism, spin-wave theory, spin-charge separation in one dimensional systems and spin-liquids as examples of systems with a topological order in two dimensions.

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 | (examination regulations for teaching-degree programmes)
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<th>Module appears in</th>
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<tr>
<td>Master’s degree (1 major) Mathematics (2016)</td>
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<td>Master’s degree (1 major) Physics (2016)</td>
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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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<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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<td>Master’s degree (1 major) Computational Mathematics (2019)</td>
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