

Module title		Abbreviation
<b>Magnetism and Spin Fluids</b>		11-MSF-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)
6	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>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.</p> <p>Possible topics are:</p> <ol style="list-style-type: none"> <li>1. Principles of magnetism. Ferromagnetic and antiferromagnetic exchange, super-exchange, Hubbard, t-j- and Heisenberg models</li> <li>2. Magnetic order (Holstein-Primakoff bosons and spin-wave theory)</li> <li>3. Valence bond solids in spin chains (Majumdar-Gosh and AKLT Models, spinon confinement and the Haldane gap)</li> <li>4. Critical spin-1/2 chains (spinon excitations in the Haldane-Shastry model, holon excitations in the Kuramoto-Yokohama model)</li> <li>5. Coupled spin chains and ladders</li> <li>6. Chiral spin liquids (Abelian and possibly non-Abelian)</li> <li>7. Kitaev's toric code model (spinon and vison excitations)</li> <li>8. Kitaev's honeycomb lattice model (non-Abelian statistics).</li> </ol>		
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)		
<p>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).</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		
180 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) Mathematics (2016)  
 Master's degree (1 major) Physics (2016)  
 Master's degree (1 major) Mathematical Physics (2016)  
 Master's degree (1 major) Computational Mathematics (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) Computational Mathematics (2019)  
 Master's degree (1 major) Mathematics (2019)