## Module description

<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
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<tbody>
<tr>
<td>Low Dimensional Structures</td>
<td>11-NDS-161-m01</td>
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<table>
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<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
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<tr>
<td>Managing Director of the Institute of Applied Physics</td>
<td>Faculty of Physics and Astronomy</td>
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<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Other prerequisites</th>
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<tr>
<td>6</td>
<td>numerical grade</td>
<td>Approval from examination committee required.</td>
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### Contents

Low-dimensional structures: Crystal lattice symmetry. Lattice dynamics and growth techniques of low-dimensio-
nal structures. Comparison between these structures and volume solids. X-ray diffractometry. Molecular beam.epitaxy.

### Intended learning outcomes

The students have knowledge of the theoretical principles of the growth of low dimensional structures. They
know methods of producing and analysing such structures. They know the bandstructures of the most important
semiconductors as well as the fabrication and characteristics of semiconductor heterostructures and MOS-di-
odes. They are familiar with the subband structure of semiconductor heterostructures and MOS-diodes and can
evaluate the importance of many-particle effects. They are able to solve problems related to potentials in one
dimension by applying Poisson's equation. They know the k*p perturbation theory and can deduce the 2D sub-
band structure from the bulk band structure. They have knowledge of the meaning of modulation doping and are
familiar with the 2D hydrogen atom. They understand how an external magnetic field acts on the properties of a
free electron gas in 2D. They have basic knowledge of the meaning of gauging, Landau-quantisation, filling fac-
tor and Landau degeneracy. They understand the dependence of various physical properties on the filling factor,
and are able to solve implicit problems via numerical methods. They are familiar with elementary excitations in
two-dimensional systems.

### Courses

(type, number of weekly contact hours, language — if other than German)

| V (3) + R (1) |

### Method of assessment

(type, scope, language — if other than German, examination offered — if not every semester, information on whether
module is creditable for bonus)

a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 mi-
utes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (ap-
prox. 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 in-
stead 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 exami-
nation date at the latest.

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) Physics (2016)
Master's degree (1 major) Nanostructure Technology (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)