## Module: Experimental Quantum Optics

<table>
<thead>
<tr>
<th>Code</th>
<th>72190</th>
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<tbody>
<tr>
<td>Instruction language</td>
<td>English</td>
</tr>
<tr>
<td>ECTS credits</td>
<td>6</td>
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<tr>
<td>Credit hours</td>
<td>5</td>
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<tr>
<td>Duration</td>
<td>1 semester</td>
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<tr>
<td>Cycle</td>
<td>Each winter semester</td>
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<tr>
<td>Coordinator</td>
<td>Dean of Physics Studies</td>
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<tr>
<td>Lecturer</td>
<td>Prof. Alexander Kubanek</td>
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### Allocation to study programmes
- Physics M.Sc., elective module, 1st or 2nd semester
- Wirtschaftsphysik M.Sc., elective module, 1st - 3rd semester

### Formal prerequisites
None

### Recommended prerequisites
- Optics, Atomic Physics, Quantum Mechanics

### Learning objectives
- Students who successfully passed this module
  - are familiar with concepts and techniques used in modern Quantum Optics
  - know the application of Laser Physics and the applications of laser for cavity QED

### Syllabus
- Laser Physics
- Quantum nature of light
- Interaction of light and matter
- Atomic and "atom-like" systems
- Cavity Quantum Electrodynamics
- Current research topics in Quantum Optics (Nonlinear Optics, Quantum Entanglement, Bell’s inequalities, Quantum Teleportation, Quantum Cryptography, Quantum Computing)

### Literature
Specific literature will be provided throughout the course. In-depth literature research is also part of independent preparation of the student presentations.

Quantum Optics books for general preparation:
- G. Grynberg, A. Aspect and C. Fabre, Introduction to Quantum Optics
- R. Loudon, The Quantum Theory of Light (Oxford University Press)
- M. O. Scully and M. S. Zubairy, Quantum Optics (Cambridge University Press, Cambridge, 1997)

More specialized books:
- C. Cohen-Tannoudji, J. Dupont-Roc, and G. Grynberg, Atom-Photon Interactions (Wiley-Interscience); comment: specialized on Light Atom Interaction
- S. Haroche, J. M. Raimond, Exploring the Quantum, (Oxford
Teaching and learning methods

<table>
<thead>
<tr>
<th></th>
<th>Lecture (3 hours per week)</th>
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<tr>
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<td>Exercise (2 hours per week)</td>
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Workload

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<tr>
<td>45 hours lecture (attendance time)</td>
<td>30 hours exercise (attendance time)</td>
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<tr>
<td>105 hours self-study and exam preparation</td>
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<td>Total: 180 hours</td>
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Assessment

Written or oral examination. A prerequisite for the participation in the examination is an ungraded course achievement. Form and scope of the examination and of the course achievement are determined and notified by the lecturer at the beginning of the course.

Examination

13079 Experimental Quantum Optics (precourse)
13078 Experimental Quantum Optics

Grading procedure

The module grade is the examination grade.

Basis for

Research in the fields of Quantum Information and Technologies