Module	***Experimental Quantum Optics***
Code	72190
Instruction language	English
ECTS credits	6
Credit hours	5
Duration	1 semester
Cycle	Each winter semester
Coordinator	Dean of Physics Studies
Lecturer	Prof. Alexander Kubanek
Allocation to study programmes	Physics M.Sc., elective module, 1st or 2nd semester Wirtschaftsphysik M.Sc., elective module, 1st - 3nd 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: • C. C. Gerry and P. L. Knight, Introductory Quantum Optics (Cambridge University Press, Cambridge, 2005) • G. Grynberg, A. Aspect and C. Fabre, Introduction to Quantum Optics • M. Fox, Quantum Optics An introduction (Oxford University Press) • G. Agarwal, Quantum Optics, (Cambridge University Press, Cambridge, 2013) • 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 University Press 2006) Comment: “Specialized on cavity quantum electrodynamics” • M. Nielsen, I. Chuang – Quantum Computation and Quantum Information, (Cambridge University Press, Cambridge, 2009). • Comment: “Specialized on quantum information”
Teaching and learning methods	Lecture (4 hours per week) Exercise (1 hour per week)
Workload	45 hours lecture (attendance time) 30 hours exercise (attendance time) 105 hours self-study and exam preparation Total: 180 hours
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