



Module	<i>Theoretical Quantum Optics</i>
Code	71420
Instruction language	English
ECTS credits	6
Credit hours	5
Duration	1 semester
Cycle	Summer semester
Coordinator	Dean of Physics Studies
Lecturer	Prof. Wolfgang Schleich, Dr. Maxim Efremov
Allocation to study programmes	Physics M.Sc., elective module, 1 st or 2 nd semester Wirtschaftsphysik M.Sc., elective module, 1 st - 3 rd semester
Formal prerequisites	None
Recommended prerequisites	Non-relativistic Quantum Mechanics, classical Electrodynamics, Thermodynamics and Statistics
Learning objectives	Students who successfully passed this module <ul style="list-style-type: none">• are familiar with the concepts of theoretical quantum optics• are able to transfer their knowledge to other branches of physics
Syllabus	<ul style="list-style-type: none">• Quantum phase-space distributions, and in particular, the Wigner function• Tools of semi-classical quantum mechanics• Wave packet dynamics and connections to number theory• Quantization of the radiation field• Interaction Hamiltonian of light and matter• Jaynes-Cummings model• Atom optics with classical and quantized light fields
Literature	<ul style="list-style-type: none">• W.P. Schleich, Quantum Optics in Phase Space (Wiley-VCH, Weinheim, 2001)• M.O. Scully and M.S. Zubairy, Quantum Optics (Cambridge University Press, Cambridge, 1997)• R. J. Glauber, Quantum Theory of Optical Coherence (Wiley-VCH, Weinheim, 2007)• C.C. Gerry and P.L. Knight, Introductory Quantum Optics (Cambridge University Press, Cambridge, 2005)
Teaching and learning methods	Lecture (3 hours per week) Exercise (2 hours 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	11975 Theoretical Quantum Optics (precourse) 11959 Theoretical Quantum Optics
Grading procedure	The module grade is the examination grade.
Basis for	Research in the fields of Quantum Information and Technologies
