Module	***Optical and quantum metrology***
Code	
Instruction language	English
ECTS credits	6
Attendance time	5 hours per week
Duration	1 semester
Cycle	Each winter semester
Coordinator	Dean of Physics Studies
Lecturer	Dr. Enno Giese, Dr. Sabine Wölk
Allocation to study programmes	Physics M.Sc., elective module Wirtschaftsphysik M.Sc., elective module
Recommended prerequisites	Optics and Electrodynamics, Quantum Mechanics
Learning objectives	Students who successfully passed this module • are familiar with the concepts of quantum optics and metrology • able to transfer methods to other fields in quantum sensing and technology
Syllabus	• Jump start into quantum optics • Linear and nonlinear optical devices • Entanglement, correlations, and quantum imaging • Optical interferometry with quantum states of light • Nonlinear interferometry • Phase and parameter estimation
Literature	• G. Grynberg, A. Aspect and C. Fabre, "Introduction to Quantum Optics: From the Semi-classical Approach to Quantized Light" (Cambridge University Press, 2010) • M. Suda, "Quantum Interferometry in Phase Space: Theory and Applications" (Springer, 2006) • W. P. Schleich, "Quantum Optics in Phase Space" (VCH-Wiley, 2001) • C. C. Gerry and P. L. Knight, "Introductory Quantum Optics" (Cambridge UniversityPress, 2005) • D. S. Simon, G. Jaeger and A. V. Sergienko, "Quantum Metrology, Imaging, and Communication" (Springer, 2017)
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	The module assessment consists of a graded written or oral exam. Participation in the examination requires an ungraded academic work. Examination form as well as form, content and scope of the academic work will be announced at the beginning of the lecture.

Examination	
Grading procedure	The module grade is equal to the examination grade.
Basis for	Research in the fields of quantum metrology, sensing, and technology