Module	***Path Integrals***
Code	72425
Instruction language	English
ECTS credits	3
Credit hours	2
Duration	1 semester
Cycle	Irregularly
Coordinator	Dean of Physics Studies
Lecturer	Prof. Joachim Ankerhold, Dr. Björn Kubala
Allocation to study programs	Physics M.Sc., elective module, 1st or 2nd Semester
Formal prerequisites	None
Recommended prerequisites	Fundamentals of Quantum Mechanics
Learning objectives	Students who successfully passed this module have a deep knowledge in Path Integrals.
Syllabus	In this course, we will start with very basic derivations of path integrals for simple quantum systems (e.g. harmonic oscillator) to learn techniques to evaluate them and to get insight into their subtleties. We will then proceed with perturbative techniques (semi-classics, anharmonic systems), open quantum systems (reduced densities), coherent state path integrals and path integrals for fermionic systems (Grassmann fields). Corresponding techniques will be applied to simple examples to illustrate the underlying physics.
Literature	• H. Kleinert, Path Integrals in Quantum Mechanics, Statistics, and Polymer Physics, and Financial Markets, World Scientific; http://users.physik.fu-berlin.de/~kleinert/kleinert/?p=booklist • L. Schulman, Techniques and Applications of Path Integration, John Wiley & Sons. • R. Feynman, A. Hibbs, Quantum mechanics and Path Integrals, McGraw Hill
Teaching and learning methods	Lecture (2 hour per week)
Workload	30 hours (attendance time) 60 hours self-study and examination preparation Total: 90 hours
Assessment	Oral examination.
Examination	13542 Path Integrals
Grading procedure	The module grade is the examination grade.

Basis for	Research in quantum physics