Advanced Quantum Theory Syllabus

Course of studies:	Master in Physics - 1st semester - All Specializations
Title:	**Advanced Quantum Theory**
Semester:	Winter term 2018-2019
Lecturer:	Prof. Dr. Silvana Botti Abbeanum Fröbelstieg 1, Room 109 Office hours: by appointment Telephone: +49 (0)3641 947150 Email: silvana.botti@uni-jena.de
Web page	http://www.ico.uni-jena.de/index.php?page=en IFTO → Teaching → lectures (Password: AQT#18)
Schedule:	Lectures: 4 hours per week Tutorials: 2 hours per week
ECTS credit points	**8**
Language:	English
Class times:	Lectures: **TUE** - 8:00 - 10:00 ; HS2 Abbeanum, Fröbelstieg 1 **THU** - 8:00 - 10:00 ; HS2 Abbeanum, Fröbelstieg 1 Tutorials: **MON** - 8:00 - 10:00 ; SR2 Physik, Helmholtzweg 5 **WED** - 8:00 - 10:00 ; SR1 Physik, Max-Wien-Platz 1
Tutorials	Dr. Luca Zambelli (**MON**) Abbeanum Fröbelstieg 1, Room 306 Office hours: by appointment Telephone:+49 (0)3641 947135 email:luca.zambelli@uni-jena.de MSc. Alessandro Ugolotti (**WED**) Abbeanum Fröbelstieg 1, Room 311 by appointment +49 (0)3641 947097 alessandro.ugolotti@uni-jena.de
Prerequisites:	(Quantum Theory)
Work load:	Lectures/Tutorials: 90h Individual work (studying, homework, exam preparation): 150h Total work load: 240 hours
Homework	There will be 10 problem sets. The homework is assigned weekly: it can be downloaded from the web page on Tuesday (starting on 18.10) http://www.ico.uni-jena.de The homework is due in class at the end of the lecture on the following Tuesday, solutions will be discussed after one week in

	the tutorial class. You are expected to work on problem sets primarily on your own, as you need to get ready for the exam. I do encourage you to discuss the problems with each other after you have made a serious effort to solve them on your own.
Objectives/Competences:	Quantum theory is the fundamental framework within which a vast section of modern physics is cast: this includes atomic, molecular and particle physics as well as condensed matter and statistical physics, and modern quantum chemistry. Building upon the notions introduced in the introductory lecture on quantum theory, this course will cover key ideas and basic techniques of advanced quantum mechanics. After completing successfully this course, students will master the formalism and the methods of quantum mechanics and they will be able to start research in different areas of theoretical physics, or build simple models for experimental results in terms of quantum mechanics.
Content:	The lecture will cover several topics: • Many particle systems • Addition of angular momenta • Time-dependent perturbation theory • Scattering theory • Introduction to relativistic quantum mechanics • Relativistic hydrogen atom • Path integrals
Course grading:	A minimum of 50% of the total points that can be obtained from the solution of the 10 homework assignments is required to access to the written examination. Written examination: 7.2.2019
Teaching methods:	Blackboard - beamer presentations - weekly questions&answers - class activities - homework assignments with solutions
Textbooks:	J.J. Sakurai, J. Napolitano, “Modern Quantum Mechanics - Second Edition” (Addison-Wesley).
Recommended books:	C. Cohen-Tannoudij, B. Diu and F. Laloe; “Quantum Mechanics I+II” (John Wiley & Sons). G. Gottfried and T.M. Yan, “Quantum Mechanics: Fundamentals”, (Springer). M. Bartelmann, B. Feuerbacher, T. Krüger, D. Lüst, A. Rebhan, A. Wipf, “Theoretische Physik” (Springer).