研究生专业基础课程教学大纲
(Syllabus)

课程代码 Course Code	PHY6007H	*学时 Teaching Hours	64	*学分 Credits	4

*课程名称 Course Name	（中文）高等量子力学
	（English）Advanced Quantum Mechanics

*授课语言 Instruction Language	English

*开课院系 School	Physics & Astronomy

*先修课程 Prerequisite	None（若有，请给出具体课程名称及课程代码；若无，请写"无"）

授课教师 Instructors	姓名 Name	职称 Title	单位 Department	联系方式 E-mail
	Antonio Miguel Garcia Garcia	Full Professor	Physics and Astronomy	amgg@sjtu.edu.cn

*课程简介 （中文） Course Description	这门高级量子力学课程旨在提高学生对量子力学中几个高级主题的理解，包括但不限于散射理论、相对论量子力学、微扰技术和多体量子力学，包括二次量子化和相同粒子。完成本课程后，学生将具备研究统计量子力学、核与粒子物理学以及凝聚态物理学的必要背景知识。

*课程简介 （English） Course Description	This advanced quantum mechanics course aims to advance students' understanding of quantum mechanics including, but not limited to, scattering theory, relativistic quantum mechanics, perturbative techniques and many-body quantum mechanics including second quantization and identical particles. After having taken the course, the student will have acquired the necessary background for studies in statistical quantum mechanics, nuclear and particle physics, and condensed matter physics.

	教学内容 Content	授课学时 Hours	教学方式 Format	授课教师 Instructor
*教学安排 Schedules	From Planck to Dirac: Quantum mechanics and the people who made it	2	课堂教学	Antonio M Garcia Garcia
	Fundamental concepts: The Schroedinger equation. Wavefunction and its probabilistic interpretation. Operators, observables and its quantization. Postulates of quantum mechanics and Dirac bra-ket formalism	4.5	课堂教学	Antonio M Garcia Garcia
	Learning to solve the Schroedinger eq: harmonic oscillator, delta function, potential wells. Algebraic approaches	4	课堂教学	Antonio M Garcia Garcia
	Angular momentum and the Quantum Hydrogen atom	4	课堂教学	Antonio M Garcia Garcia
	Symmetries in Quantum Mechanics	2	课堂教学	Antonio M Garcia Garcia
	Quantum charged particle in a magnetic field	4	课堂教学	Antonio M Garcia Garcia
	Introduction to relativistic quantum mechanics: origin of spin and addition of angular momentum	6	课堂教学	Antonio M Garcia Garcia
	Time independent perturbation theory. Degenerate, non-degenerate and variational approaches. Applications: the Helium and Hydrogen atoms	9	课堂教学	Antonio M Garcia Garcia
	Quantum dynamics and time dependent perturbation theory.	6	课堂教学	Antonio M Garcia Garcia

	Quantum Scattering theory: partial wave expansion and perturbative Born-Oppenheimer formalisms	6.5	课堂教学	Antonio M Garcia Garcia
	Many body quantum mechanics: entanglement, identical particles and second quantization.	10	课堂教学	Antonio M Garcia Garcia
	Introduction to quantum information	3	课堂教学	Antonio M Garcia Garcia
	Examples of Many-Body quantum mechanics: Ground state energy of the clean 1d Hubbard model and BCS theory of superconductivity	3	课堂教学	Antonio M Garcia Garcia
*考核方式 Grading Policy	Final 50% , Midterms (30%) + Assignments (20%) = 100% Some of the assignment would be small projects to be carried out in groups that would require some coding skills.			
*教材/讲义或参考资料 Textbooks & References	[1] Quantum Mechanics, Franz Schwabl, Springer, 4th edition, 2014 [2] Quantum Mechanics, Bransden, B.H., Joachain, C.J, Longman. 2nd edition, 2000 [3] Modern Quantum Mechanics : Sakurai, J. J., Napolitano, Jim, 3rd edition, 2020, Cambridge University Press. [4] Advanced Quantum Mechanics, Franz Schwabl, Springer, 4th edition, 2014 [5] Quantum Mechanics: Fundamentals, K. Gottfried, Springer, 2nd edition, 2004 [6] Quantum Information Theory, M. M. Wilde, Cambridge University Press, 2013 [7] The Principles of Quantum Mechanics, P. A. M. Dirac, Oxford Press, 1968			
备注 Notes				

备注说明：

1. 带*内容为必填项；均为中英文填写。

2. 课程简介字数为 300-500 字；教学内容、进度安排等以表述清楚教学安排为宜，字数不限。