研究生课程教学大纲（Syllabus）

<table>
<tr><td>课程代码
Course Code</td><td>PHY6005H</td><td>*学时
Teaching Hours</td><td>64</td><td>*学分
Credits</td><td>4</td></tr>
<tr><td rowspan="2">*课程名称
Course Name</td><td colspan="5">研究生量子力学</td></tr>
<tr><td colspan="5">Advanced Quantum Mechanics</td></tr>
<tr><td>*授课语言
Instruction Language</td><td colspan="5">English</td></tr>
<tr><td>*开课院系
School</td><td colspan="5">Physics and Astronomy</td></tr>
<tr><td>先修课程
Prerequisite</td><td colspan="5">Elementary Quantum Mechanics</td></tr>
<tr><td rowspan="4">授课教师
Instructors</td><td>姓名 Name</td><td>职称 Title</td><td colspan="2">单位 Department</td><td>联系方式 E-mail</td></tr>
<tr><td>Antonio Miguel Garcia Garcia</td><td>Professor</td><td colspan="2">Physics and Astronomy</td><td>amgg@sjtu.edu.cn</td></tr>
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<tr><td></td><td></td><td colspan="2"></td><td></td></tr>
<tr><td>*课程简介（中文）Course Description</td><td colspan="5">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。</td></tr>
<tr><td>*课程简介（English）Course Description</td><td colspan="5">This advanced quantum mechanics course aims to advance students' understanding of several advanced topics in quantum mechanics including, but not limited to, scattering theory, relativistic quantum mechanics, perturbative techniques and many-body quantum mechanics including second quantization and identical particle. After having taken the course, the student will have acquired the necessary background for studies in statistical quantum mechanics,</td></tr>
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<tr><td></td><td colspan="5">nuclear and particle physics, and condensed matter physics.</td></tr>
<tr><td rowspan="13">*教学安排
Schedules</td><td>周次
Week</td><td>教学内容
Content</td><td>授课学时
Hours</td><td>教学方式
Format</td><td>授课教师
Instructor</td></tr>
<tr><td>1</td><td>From Planck to Dirac: Quantum mechanics and the people who made it.</td><td></td><td></td><td></td></tr>
<tr><td>2</td><td>Review of 1d Schroedinger equation: potential well and barrier, delta function and harmonic oscillator potential. Introduction to operator formalism.</td><td></td><td></td><td></td></tr>
<tr><td>3</td><td>Dirac Bra-ket formalism. Operators and states in Quantum mechanics.</td><td></td><td></td><td></td></tr>
<tr><td>4</td><td>Symmetries in Quantum Mechanics</td><td></td><td></td><td></td></tr>
<tr><td>5</td><td>Schroedinger equation in more than one dimension. Radial potentials and the Hydrogen atom. Angular momentum.</td><td></td><td></td><td></td></tr>
<tr><td>6</td><td>Quantum charged particle in a magnetic field.</td><td></td><td></td><td></td></tr>
<tr><td>7</td><td>Spin and addition of angular momentum</td><td></td><td></td><td></td></tr>
<tr><td>8</td><td>Introduction to time independent perturbation theory for non-degenerate and degenerate eigenvalues.</td><td></td><td></td><td></td></tr>
<tr><td>9</td><td>Applications in atomic, nuclear and condensed matter: Zeeman and Stark effects. Relativistic corrections and hyperfine stricture</td><td></td><td></td><td></td></tr>
<tr><td>10</td><td>Variational methods. The He atom. WKB approximation. (0.5)</td><td></td><td></td><td></td></tr>
<tr><td>11</td><td>Introduction of Dirac’s picture and perturbative time dependent</td><td></td><td></td><td></td></tr>
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		formalism. Kicked oscillator, kicked potential well and harmonic perturbation. Fermi Golden rule.			
	12	Sudden and adiabatic approximations. Interaction matter and radiation.			
	13	Classical scattering theory. Differential cross section. Rutherford scattering. Introduction quantum scattering theory. Partial wave approach.			
	14	Partial wave approach (continued) and Born approximation. Examples: Hard and soft sphere, well potential.			
	15	Concept of quantum identical particles. Spin-statistic theorem and example of bosonic and fermionic wavefunctions. Free Fermi gas, neutrons stars and the He atom revisited.			
	16	Second quantization. Introduction to the formalism and some examples			
*考核方式 Grading Policy	Final 40% Midterm 30% Homework 30%				
*教材或参考资料 Textbooks & References	Advanced Quantum Mechanics, Franz Schwabl, 4th edition Quantum Mechanics, Franz Schwabl, 4th edition Quantum Mechanics, Bransden, B.H., Joachain, C.J. 2nd edition Modern Quantum Mechanics : Sakurai, J. J., Napolitano, Jim, 3rd edition				
备注 Notes					

备注说明：

1．带*内容为必填项；

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。