

研究生课程教学大纲 (Syllabus)

课程代码 Course Code	PHY6301	*学时 Teaching Hours	64	*学分 Credits	4
*课程名称 Course Name	高等凝聚态物理 Advanced Condensed Matter Physics				
*授课语言 Instruction Language	中文				
*开课院系 School	物理与天文学院				
先修课程 Prerequisite	量子力学、统计物理、固体物理 Quantum Mechanics; Statistical Physics; Solid State Physics				
授课教师 Instructors	姓名 Name	职称 Title	单位 Department	联系方式 E-mail	
	姚元 (Yao Yuan)	副教授	物理与天文学院	yao.yuan.134@hotmail.com	
*课程简介 (中文) Course Description	<p>本课程的教学计划如下：二次量子化、Hartree-Fock 近似、固体中的能带和自由波展开、晶体中的集体激发和声子、介电常数与屏蔽、Thomas-Fermi 屏蔽、Lindhard 屏蔽、声诱导电子相互作用、超导 (BCS 理论、Landau-Ginzburg 理论)、Bloch 定理、紧束缚表示和 LCAO 方法；量子铁磁/反铁磁的机制、Hubbard 系统 (多体系统的微扰论)、量子自旋系统 (自旋波近似、Holstein-Primakoff 表示法)、反铁磁 (Bogoliubov 变换)、自发对称性破缺、Landau 能级、整数霍尔效应与 Laughlin 论述、边界态。</p>				
*课程简介 (English) Course Description	<p>The course is planned to cover the following topics: second quantization, Hartree-Fock approximation, Collective excitations and phonons, Dielectricity and screening, Thomas-Fermi screening, Lindhard screening, phonon-mediated interaction, superconductivity (BCS theory, Landau-Ginzburg theory). Band structures and free-wave expansion, tight-binding representation of systems and LCAO method; Quantum (anti-)ferromagnets and their mechanisms, Hubbard physics (perturbation theory), quantum spin systems (spin-wave approximation, Holstein-Primakoff transformation), Landau critical velocity criterion), spontaneously symmetry breaking, quantum antiferromagnets (Bogoliubov transformation). Landau levels, integer quantum Hall effect and Laughlin argument, boundary modes.</p>				
*教学安排 Schedules	周次 Week	教学内容 Content	授课学时 Hours	教学方式 Format	授课教师 Instructor
	1-2	Second quantization	6	讲授	姚元

	2-3	Hatree-Fock approximation	6	讲授	姚元
	4	Phonons	4	讲授	姚元
	5	Screening and dielectricity	4	讲授	姚元
	6-7	Superconductivity	8	讲授	姚元
	8	Band structure	4	讲授	姚元
	9-11	Hubbard physics and Quantum magnetisms	10		
	11-14	Quantum Hall effects and topological matter	12	讲授	姚元
*考核方式 Grading Policy	Homework 50%; Participation 10%; Midterm Exam 20%; Final Exam 20%.				
*教材或参考资料 Textbooks & References	Bruus & Flensberg, <i>Many-Body Quantum Theory in Condensed Matter Physics</i> Ashcroft & Mermin, <i>Solid State Physics</i> Schwabl, <i>Advanced quantum mechanics</i> Altland & Simons, <i>Condensed Matter Field Theory</i> Leggett, <i>Quantum Liquids</i>				
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。