研究生课程教学大纲（**Syllabus**）

课程代码 Course Code	PHY6201	*学时 Teaching Hours	64	*学分 Credits	4
*课程名称 Course Name	（中文）非线性光学				
	（English）Nonlinear Optics				
*授课语言 Instruction Language	英语 English				
*开课院系 School	物理与天文学院 School of Physics and Astrophysics				
先修课程 Prerequisite	几何光学、波动光学、电磁学 Geometric Optics, Wave Optics, Electromagnetism				

授课教师 Instructors	姓名 Name	职称 Title	单位 Department	联系方式 E-mail
	俞进 YU Jin	教授 Professor	物理与天文学院 School of Physics and Astrophysics	jin.yu@sjtu.edu.cn

*课程简介（中文） Course Description	非线性光学研究光，尤其是强激光，与物质的相互作用，通过物质光学性质随着光的入射而改变，以及物质对入射光特性的调制这样两个相辅相成的方面来揭示这种相互作用的秘密和规律。在现代光科学和光学工程普遍使用激光器，特别是超强、超快激光作为激发光源的背景下，伴随着新型非线性光学材料和器件的研制和广泛应用，对非线性光学原理的掌握以及对非线性光学现象的理解已经成为一名从事光学以及相关领域（如激光、光电技术、光及光子通讯、超强超快激光等）研究和开发工作的科学研究人员和工程技术人员所必需具备的能力。 　　本课程以美国 Rochester 大学 Robert W. Boyd 教授所著 Nonlinear Optics（3rd ed.）一书为基础来讲授，在给定的课时里对上述参考书的内容进行了删选。考虑到作为一门研究生专业基础课程所应具有的普适性和实用性，删选的原则是给学生提供一个完整、自洽的知识体系，并充分地强调对现象的描述和对物理意义的解释。因此删除了参考书中基于量子力学描述的章节，将整个知识体系建筑在纯经典麦克斯韦电磁波的理论上，把对非线性光学量子力学处理相关内容留给了其它专业课程，如原子分子物理和量子光学。课程内容通过六个章节来讲授（见以下教学安排），其中第一章至第三章阐述非线性光学的基本原理以及描述相关过程所必须的数学工具；余下三章则对重要的非线性光学现象进行比较详细的研究。整个课程中数学工具的使用使得该课程既能满足实验物理或工程物理各领域学生的需求，也能为从事理论物理方向研究的学生打好基础。
*课程简介（English） Course Description	Nonlinear Optics studies the interaction between light and matter, especially when the first becomes strong enough. More precisely, this branch of Optics reveals the mysteries and the principles of such interaction through the investigation of two complementary aspects which consist on the one hand, in the modification of the optical behavior of matter and on the other hand, in the modulation of the property of incident light. Because of the widespread use of laser, and especially ultra-short and ultra-intense lasers, as exciting source in modern optical science and engineering and the rapid development of nonlinear optical materials and devises, mastering the principle of Nonlinear Optics and understanding nonlinear optical phenomena correspond today to a basic skills for scientific researchers and engineers working in

relative domains of Optics such as laser, photonics, optical and photonic communication, as well as ultra-fast and ultra-intense lasers.

This course is based on the book "Nonlinear Optics (3rd ed.)" by Robert W. Boyd, Professor from Rochester University in USA. Materials are selected according to the teaching times available for the course. Considering necessary balance between general purpose and practical utility of a basic course at the graduate level, the material selection intends to provide students a complete and self-consistent knowledge system, while emphasizing description of the phenomena and associated physical explanations. It is why the chapters in the reference book concerning Quantum Mechanics description of nonlinear optical phenomena have not been included in this course, which in fact is based on the classical Maxwell theory. By doing so, the Quantum Mechanics treatment in Nonlinear Optics has been left to other advanced courses such as Atomic and Molecular Physics or Quantum Optics. The remaining materials in the reference book have been organized into 6 chapters (see below the teaching schedule): Chapters 1 to 3 expose the principle of Nonlinear Optics together with the needed mathematics tools for describing the related processes; the remaining 3 chapters are devoted to the description of most important nonlinear optical phenomena.

*教学安排 Schedules	教学内容 Content	授课学时 Hours	教学方式 Format	授课教师 Instructor
	Ch. 1: The Nonlinear Optical Susceptibility	18	Lecture	YU Jin
	Ch. 2: Wave-Equation Description of Nonlinear Optical Interactions	15	Lecture	YU Jin
	Midterm	2	Midterm	
	Ch. 3: The Intensity-Dependent Refractive Index	11	Lecture	YU Jin
	Ch. 4: Processes Resulting from the Intensity-Dependent Refractive Index	7	Lecture	Yu Jin
	Ch. 5: Ultrafast Nonlinear Optics	7	Lecture	YU Jin
	Ch. 6: Ultra-Intense Field Nonlinear Optics	4	Lecture	YU Jin
*考核方式 Grading Policy	作业(10%)，期中考试(30%)，期末考试(60%)			
*教材或参考资料 Textbooks & References	Nonlinear Optics, 3rd ed., Robert W. Boyd, Elsevier.			
备注 Notes	每周布置作业，共有习题 15 套。由 TA 负责批改			

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。

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