

课程大纲

COURSE SYLLABUS

1.	课程代码/名称 Course Code/Title	非线性光学原理 Principle of Nonlinear Optics
2.	课程性质 Compulsory/Elective	专业选修课 Elective
3.	课程学分/学时 Course Credit/Hours	3/48
4.	授课语言 Teaching Language	英语 English
5.	授课教师 Instructor(s)	戴亚南 Dai, Yanan
6.	是否面向本科生开放 Open to undergraduates or not	是 Yes
7.	先修要求 Pre-requisites	<p>(如面向本科生开放, 请注明区分内容。 If the course is open to undergraduates, please indicate the difference.)</p> 电动力学 II Electrodynamics II, PHY208 量子力学 II Quantum Mechanics II, PHY305 固体物理 Solid State Physics, PHY321-15
8.	教学目标 Course Objectives	<p>(如面向本科生开放, 请注明区分内容。 If the course is open to undergraduates, please indicate the difference.)</p> <p>非线性光学是现代光学的一个重要分支, 主要研究强光场与物质的相互作用。它在光学倍频与混频、超快光学开关、光通信、非线性与瞬态光谱探测、超快量子物态调控等领域有着非常广泛的应用。结合书本知识与前沿的科学工作研究, 本课程将重点介绍非线性光学的基本概念与原理, 简单讲述其关键的科研与工程应用。课程旨在使学生了解常见非线性过程及其应用; 研究生要求掌握相关非线性过程的理论模型。</p> <p>Nonlinear Optics is an important branch of modern optics that studies the interaction of intense laser light with matter. It has broad applications in optical harmonic generations and wave mixing, ultrafast optical switching, optical communications, nonlinear and transient optical spectroscopies, and ultrafast control of quantum phases of matter. By combining textbook materials and cutting-edge research studies, this course aims to introduce the fundamental concepts and principles of nonlinear optics, and their scientific and engineering applications. Students are expected to understand basic nonlinear optical processes and their applications; graduate students are required to master the corresponding mechanisms and related derivations.</p>
9.	教学方法 Teaching Methods	<p>(如面向本科生开放, 请注明区分内容。 If the course is open to undergraduates, please indicate the difference.)</p> <p>本课程以授课为主, 辅以课堂讨论、专题调研报告等其他方式。 Mainly in lecture talks, with interactive class discussions, topic study report or group presentation.</p>
10.	教学内容 Course Contents	<p>(如面向本科生开放, 请注明区分内容。 If the course is open to undergraduates, please indicate the difference.)</p>
	Section 1	非线性光学简介 Introduction to nonlinear optics

Section 2	介质的非线性极化 Nonlinear optical susceptibility
Section 3	晶体中的二阶非线性过程 Second order nonlinear processes in crystals
Section 4	晶体中的三阶非线性过程 Third order nonlinear processes in crystals
Section 5	非线性折射率效应 Intensity-dependent refractive index
Section 6	自发与受激光散射 Spontaneous and stimulated light scattering
Section 7	非线性多光子吸收 Nonlinear multiphoton absorption
Section 8	超快与强场非线性光学 Ultrafast and strong-field nonlinear optics
Section 9	
Section 10	
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11. 课程考核
Course Assessment

(① 考核形式 Form of examination; ②. 分数构成 grading policy; ③ 如面向本科生开放, 请注明区分内容。
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课后作业占比 40%, 个人/小组调研报告占比 30%, 期末口头报告占比 30%。
40% homework assignments, 30% research subject review report, or 30% project presentation.

12. 教材及其它参考资料
Textbook and Supplementary Readings

Robert Boyd, Nonlinear Optics, 3rd edition, Academic press, 2008
Geoffrey New, Introduction to Nonlinear Optics, Cambridge press, 2011
石顺祥, 非线性光学, 第二版, 西安电子科技大学出版社, 2012