

课程大纲 COURSE SYLLABUS

| | | |
|-----|--|--|
| 1. | 课程代码/名称 Course Code/Title | PHY5055/信息光学 Information Optics |
| 2. | 课程性质 Compulsory/Elective | 专业选修课 Elective Course |
| 3. | 课程学分/学时 Course Credit/Hours | 3/48 |
| 4. | 授课语言 Teaching Language | 中文 Chinese |
| 5. | 授课教师 Instructor(s) | 王取泉 Ququan WANG |
| 6. | 是否面向本科生开放 Open to undergraduates or not | 是 YES |
| 7. | 先修要求 Pre-requisites | (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.) 大学物理(下) PHY106 General Physics (II) |
| 8. | 教学目标 Course Objectives | (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.) 在本门课程中我们将对《信息光学》中的基本模型、物理概念、以及理论处理方法进行介绍。力争使学生理解这些模型和物理概念, 特别是标量衍射方法和傅里叶变换理论, 并初步介绍纳光子体系中的光学信息处理和半导体量子点中量子信息研究进展。 In this course, we will introduce some basic models, physical concepts, and mathematical treatments in information optics. The students will have a basic understanding on these models and concepts, especially the concepts of scalar diffraction method and Fourier transform theory. Additionally, we will briefly introduce optical information processing in nanophotonic systems and quantum information based on semiconductor quantum dots. |
| 9. | 教学方法 Teaching Methods | (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.) 本课程为理论课程, 教学以课堂讲授为主。 This course will be taught mainly with lectures in classroom. |
| 10. | 教学内容 Course Contents | (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.) |
| | Chapter 1 | 绪论 Introduction |
| | Chapter 2 | 傅里叶变换 |

| | |
|-------------------|--|
| | Introduction to Fourier Transform |
| Chapter 3 | 基础数学函数及其傅里叶变换 Basic Functions and Their Fourier Transforms |
| Chapter 4 | 线性系统 Linear System |
| Chapter 5 | 衍射标量理论基础 Scalar Diffraction Theory |
| Chapter 6 | Fresnel 与 Fraunhofer 衍射 Fresnel and Fraunhofer Diffraction |
| Chapter 7 | 透镜的傅里叶变换 Fourier Transform of Lens |
| Chapter 8 | 成像系统频谱分析与空间滤波 Frequency Spectrum in Optical Imaging and Spatial Filtering |
| Chapter 9 | 分数傅里叶变换和小波变换 Fractional Fourier & Wavelet Transforms |
| Chapter 10 | 彩虹全息术 Rainbow Holography |
| Chapter 11 | 超越光学衍射极限成像技术 Imaging Beyond Limits of Optical Diffraction |
| Chapter 12 | 纳米光学天线 Optical Nanoantennas |
| Chapter 13 | 5D 光信息存储 5-Dimensional Storage for Optical Information |
| Chapter 14 | 纳光子体系中的频谱分析 Frequency Spectrum Analysis in Nanooptics |
| Chapter 15 | 半导体量子点形貌结构 Structure of Semiconductor Quantum Dots |
| Chapter 16 | 单量子点相干特性与探测技术 Coherent Behaviours and Detection of Semiconductor Quantum Dots |
| Chapter 17 | 单量子比特旋转 Rotations of Single Qubit |
| Chapter 18 | 量子逻辑门与逻辑运算 Quantum Gates and Logical Operations |
| Chapter 19 | 激子自旋弛豫和自旋交换 Excitonic Spin Relaxation and Swap |
| Chapter 20 | 单光子与纠缠“光子对” Emissions of Single Photons and Entangled Photon-Pairs |

**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。 If the course is open to undergraduates, please indicate the difference.)

论文报告 Project 70%
现场报告 Presentation 30%

12. 教材及其它参考资料

Textbook and Supplementary Readings

教材:

J. W. Goodman, 《Introduction to Fourier Optics》, 《傅里叶光学导论》, 科学出版社, 1968 年。

参考资料:

王取泉 等, 《基于半导体量子点的量子计算与量子信息》, 中国科学技术大学出版社, 2009 年。