课程大纲
COURSE SYLLABUS

1.	**课程代码/名称** **Course Code/Title**	PHY5020/量子光学 Quantum Optics
2.	**课程性质** **Compulsory/Elective**	专业必修课 Degree Required Course
3.	**课程学分/学时** **Course Credit/Hours**	3/48
4.	**授课语言** **Teaching Language**	英文 English
5.	**授课教师** **Instructor(s)**	陈洁菲 Jiefei Chen
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.） 量子力学 I 和 II/Quantum Mechanics PHY206-15 and PHY305

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.）

量子光学，是现今光量子技术的基础，是结合光学、量子力学及原子分子光学的一门新兴学科。本课程结合光场的量子理论和光与原子相互作用的模型，介绍基本的量子光学概念及物理定律，以及关于光场的量子探测技术 。

Quantum optics is the fundamentals of the photonic quantum technology, which is rapidly developing nowadays. It is a newly developed subject, which combine optics, quantum mechanics and atomic, molecular and optical physics. Based on the quantum theory of light and the interaction model of atoms and light, this course aims to introduce the fundamental physical models and concepts in quantum optics, also the quantum measurement technology on optical fields.

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.）

授课为主，兼采用课堂讨论、专题调研及小组汇报等方式

Mainly lecture talks, combined with course discussion, topic study and presentation.

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.）

Section 1	量子光学简介 Introduction to quantum optics
Section 2	光量子技术应用；电磁波经典理论

		Perspectives on photonic quantum technology; classical theory of electromagnetic field
	Section 3	光场的量子化 Field quantization
	Section 4	简谐振子模型和单模光场 The models of harmonic oscillator and single-mode optical fields
	Section 5	光和原子相互作用的半经典模型 Semi-classical model of atom-field interaction
	Section 6	量子存储、量子密钥分发等简要概述 Introduction to quantum storage, quantum key distribution and relevant frontier topics
	Section 7	场-场、光子-光子干涉，关联函数 Field-field and photon-photon interferometry, correlation function.
	Section 8	光和原子相互作用全量子模型 Quantum theory of atom-field interaction
	Section 9	参量过程和光的压缩态 Parametric process and squeezed state of light
	Section 10	光子计数、光电流探测、光场量子态层析技术 Photon counting and photo-current detection; homodyne detection; quantum tomography of light

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.）

调研汇报：20%；平时作业：40%；笔试：40%。

Written reports: 20%; Assignment: 40%; Final Exam: 40%.

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

Quantum Optics, Marlan O. Scully and M. Suhail Zubairy, Cambridge (1997).
Introductory Quantum Optics, Christopher Gerry and Peter Knight, Cambridge University Press (2005)
The quantum theory of light (3rd), Rodney Loudon, Oxford Science Publications.
A guide to experiments in quantum optics (2nd), Hans-A. Bachor and Timothy C. Ralph, WILEY-VCH.

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