课程大纲
COURSE SYLLABUS

1.	**课程代码/名称** **Course Code/Title**	PHY5012/量子信息 Quantum Information
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)**	Oscar Dahlsten
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 PHY206-15 Quantum Mechanics I

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.）

本课程为研究生及本科高年级学生讲授量子信息科学的基本概念 。完成本课程的学生应掌握：(1) 量子信息学基本概念； (2) 量子态及测量；(3) 量子动力学基础； (4) 密度矩阵的距离测量；(5) 熵在物理学及量子物理学中的意义。

This course aims to give graduate students a foundational understanding on the research area of quantum information science. After completion of this course, students are expected to understand the following concepts: (1) General concepts in quantum information; (2) States and measurements; (3) Quantum dynamics; (4) Distance measures for density matrices; (5) Entropy;

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.）

本课程以课堂教学为主。全英文授课。致力于建立书本知识和前沿研究的联系。

This is a theoretical course. Lectures are combined with problem set and other assignments.

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	课程介绍 （第 1 周） Introduction (week 1)
Section 2	量子态及测量（第 2-4 周） States and Measurements (week 2-4)

	Section 3	量子动力学基础（第 5-7 周） Dynamics (week 5-7)
	Section 4	密度矩阵的距离测量 （第 8-9 周） Distance Measurements for density matrices (week 8-9)
	Section 5	常见的量子通信协议 （第 10-12 周） Key quantum communication protocols (week 10-12)
	Section 6	熵在物理学及量子物理学中的意义（第 13-15 周） Entropy (week 13-15)
	Section 7	时下议题 （第 16 周） Current topics (week 16)

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.）

平时作业 30%，课题答辩 20%，三小时期末考试 50%

Assignments 30%, Presentation 20%；3-hour final examination 50%

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

Nielsen, M. A. & Chuang, I. L. Quantum Computation and Quantum Information: 10th Anniversary Edition. (Cambridge University Press, 2011).
Reading Materials:
Cover, T. M. & Thomas, J. A. Elements of Information Theory: 2nd Edition
(Wiley Interscience, 2006)
Vedral, V. Introduction to Quantum Information Science
(Oxford Graduate Textzs, 2006)