课程大纲
COURSE SYLLABUS

1.	**课程代码/名称** **Course Code/Title**	**超导物理 I Basic Aspects of Superconductivity**
2.	**课程性质** **Compulsory/Elective**	专业选修课 Elective
3.	**课程学分/学时** **Course Credit/Hours**	2/32
4.	**授课语言** **Teaching Language**	英语 English
5.	**授课教师** **Instructor(s)**	安东尼·莱格特 Anthony Leggett
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.） 电动力学 II Electrodynamics II, PHY208 量子力学 II Quantum Mechanics II, PHY305 统计物理 II Statistical Mechanics II, PHY303 固体物理 Introduction to Solid State Physics, PHY321-15

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.）

The objectives of the course are (i) to provide basic introduction to fundamental phenomena of superconductivity; (ii) to help students develop basic understanding of the fundamental physics of superconductivity; and (iii) to prepare graduate and advanced undergraduate students for the task of carrying out research in the field of superconductivity.
本课程的目标是：（i）提供超导现象的基本介绍；（ii）帮助学生发展对超导物理的基本理解；以及（iii）为研究生和高级本科生做好在超导领域进行研究的准备。

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.）

This weekly course comprises (i) an in-person recitation and discussion session given by Dr. Tianyu Liu and (ii) a remote lecture given by Prof. Tony Leggett. Both graduate and undergraduate students will participate the course the same way.
本课程每周一次，每次分为两个部分：1. 现场讨论课，由刘天宇博士主持；2. 远程讲座，由莱格特教授主讲。

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	Introduction to the course, syllabus, and organization 课程介绍：教学内容与课程组织
Section 2	Generalities about superconductivity 超导概述
Section 3	Bose-Einstein condensation and the supercurrent Metastability

	玻色-爱因斯坦凝聚和超导电流亚稳定性
Section 4	Vector potential in quantum mechanics 量子力学中的矢势
Section 5	Ginzburg-Landau (GL) theory 金兹堡-朗道理论
Section 6	Normal state and electron-electron interactions 正常态和电子-电子相互作用
Section 7	BCS theory (T = 0) 零温度下的巴丁-库珀-施里弗理论
Section 8	BCS theory at finite temperatures 有限温度下的巴丁-库珀-施里弗理论
Section 9	Relation of BCS and GL theories 巴丁-库珀-施里弗理论与金兹堡-朗道理论的联系
Section 10	Dirty superconductors 含杂质超导体
Section 11	The Josephson effect 约瑟夫森效应
Section 12	“Exotic” superconductivity “奇异”超导体
Section 13	Pairing in He-3 and other Fermion systems 氦 3 和其他费米子系统中的配对
Section 14	Applications of superconductivity 超导的应用
Section 15	Application of superconductivity in quantum computing 超导在量子计算中的应用
Section 16	Course summary 课程总结

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.）

The numerical grade will be determined by the following distribution:
Homework: 3 x 25% = 75%
Term paper: 25%

分数由以下两方面构成：
习题作业：3 次，每次 25%，共 75%
课程论文：25%

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

1. C. Kittel, Introduction to Solid State Physics, 8th Ed., John Wiley & Sons, Inc., 2005.
A. J. Leggett, Quantum Liquids: Bose condensation and Cooper pairing in condensed matter systems (Oxford University Press, 2006).
2. A. J. Leggett, Lecture slides.

1.基泰尔 《固体物理导论》第 8 版
2.莱格特，超导讲义