

课程详述

COURSE SPECIFICATION

以下课程信息可能根据实际授课需要或在课程检讨之后产生变动。如对课程有任何疑问，请联系授课教师。

The course information as follows may be subject to change, either during the session because of unforeseen circumstances, or following review of the course at the end of the session. Queries about the course should be directed to the course instructor.

1.	课程名称 Course Title	统计物理 II Statistical Mechanics II				
2.	授课院系 Originating Department	物理系 Department of Physics				
3.	课程编号 Course Code	PHY303				
4.	课程学分 Credit Value	3				
5.	课程类别 Course Type	专业必修 Subject compulsory				
6.	授课学期 Semester	秋季 Fall				
7.	授课语言 Teaching Language	中英混合 both Chinese and English				
8.	授课教师、所属学系、联系方式（如属团队授课，请列明其他授课教师） Instructor(s), Affiliation & Contact (For team teaching, please list all instructors)	吴健生, 物理系, wujs@sustc.edu.cn				
9.	实验员/助教、所属学系、联系方式 Tutor/TA(s), Contact	待公布 To be announced				
10.	选课人数限额(可不填) Maximum Enrolment (Optional)					
11.	授课方式 Delivery Method	讲授 Lectures	习题/辅导/讨论 Tutorials	实验/实习 Lab/Practical	其它(请具体注明) Other (Please specify)	总学时 Total
	学时数 Credit Hours	48	0	0	考试周不算入学时	48

12. 先修课程、其它学习要求 Pre-requisites or Other Academic Requirements	热力学与统计物理 I (PHY204) Thermodynamics and Statistical Physics I
13. 后续课程、其它学习规划 Courses for which this course is a pre-requisite	量子统计 quantum statistical mechanics
14. 其它要求修读本课程的学系 Cross-listing Dept.	无 N/A

教学大纲及教学日历 SYLLABUS

15. 教学目标 Course Objectives

让学生理解统计物理的研究的对象，研究的目标，研究的方法，并且懂得应用统计物理。理解经典统计和量子统计，无相互作用系统和相互作用系统，平衡态和非平衡态的不同之处，懂得选择合适的方法去处理不同的系统。

Understand the subject, purpose and methodology of statistical mechanics and know how to apply it. Understanding the differences between classical statistical mechanics and quantum statistical mechanics, between noninteracting system and interacting systems, between equilibrium and nonequilibrium. Know how to deal with different situation with different methods.

16. 预达学习成果 Learning Outcomes

理解统计物理是研究对象是有相互作用且具有宏观粒子数的多粒子系统，目标是从体系的微观结构得到体系的宏观热力学性质。理解统计物理和热力学的联系，懂得从统计物理的角度去理解热力学四大定律。

熟悉经典的平衡态统计物理，其中主要是系综理论，懂得用系综理论去计算无相互作用系统的热力学性质。

熟悉有相互作用系统的相关现象，包括范德瓦尔斯气体的性质和相变理论。

熟悉量子统计，对懂得计算无相互作用的量子系统的热力学性质。

对非平衡统计物理有一定的认识，对刘维方程，BBGKY 递归理论，玻尔兹曼方程，H 定律等有一定的了解。

To understand that the subject of statistical mechanics is the many-particles system with/without interaction, the object is to derive the macroscopic thermal properties from the microscopic structure such as Hamiltonian. To understand the relation of statistical mechanics and thermodynamics, and know how to derive the 0-3rd law of thermodynamics from statistical mechanics.

Master the knowledge of classical statistical mechanics of equilibrium system, including the ensemble theory, know how to calculate the thermal properties of the noninteracting system;

Master the knowledge of classical statistical mechanics of interacting system, including the VdW gas and phase transition theory;

Master the density matrix, know how to calculate the thermal properties of the quantum system without interaction;

Know the basic knowledge on non-equilibrium systems, such as Liouville equation, Boltzman equation, H-theorem.

17. 课程内容及教学日历 (如授课语言以英文为主，则课程内容介绍可以用英文；如团队教学或模块教学，教学日历须注明主讲人)

Course Contents (in Parts/Chapters/Sections/Weeks. Please notify name of instructor for course section(s), if this is a team teaching or module course.)

第 1 周：数学工具

第 2 周：热力学回顾

第 3/4 周：无相互作用系统：介绍

第 5/6 周：无相互作用系统：经典情况

第 7 周：无相互作用系统：经典统计的不成立的情形

第 8 周：无相互作用系统：波色统计

第 9 周：无相互作用系统：费米统计

第 10 周：期中考

第 11 周：系综理论：微正则

第 12 周：系综理论：正则

第 13 周：系综理论：巨正则

第 14 周：相互作用系统：VdW 气体和相变理论

第 15 周：非平衡统计

第 16 周：复习回顾

Week 1 Mathematical Tools

Week 2 Thermodynamics

Week 3/4 Noninteracting Systems: Introduction

Week 5/6 Noninteracting Systems: Classical

Week 7 Noninteracting Systems: Breakingdown of Classical

Week 8 Noninteracting Systems: Quantum (Bose)

Week 9 Noninteracting Systems: Quantum (Fermion)

Week 10 Midterm exam

Week 11 Ensemble Theory: Microcanonical

Week 12 Ensemble Theory: Canonical

Week 13 Ensemble Theory: Grandcanonical

Week 14 Interacting System: VdW gas and Phase transition

Week 15 Nonequilibrium Statistical Mechanics

Week 16 Review

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

自编讲义

Kerson Huang 《Introduction to Statistical Mechanics》

梁希侠 《统计热力学》

19. 评估形式

Type of Assessment

评估时间
Time

课程评估 ASSESSMENT

占考试总成绩百分比
% of final score

违纪处罚
Penalty

备注
Notes

出勤 Attendance

课堂表现

Class Performance

小测验

Quiz

课程项目 Projects

平时作业

Assignments

期中考试

Mid-Term Test

期末考试

Final Exam

期末报告

Final

Presentation

Type of Assessment	Time	% of final score	Penalty	Notes
出勤 Attendance				
课堂表现 Class Performance		Extra 10%		
小测验 Quiz				
课程项目 Projects				
平时作业 Assignments	课后时间每次 2 小时, 大概 5 次	30%		
期中考试 Mid-Term Test	2 小时	30%		
期末考试 Final Exam	2 小时	40%		
期末报告 Final Presentation				

其它（可根据需要
改写以上评估方
式）
**Others (The
above may be
modified as
necessary)**

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20. **记分方式 GRADING SYSTEM**

<input checked="" type="checkbox"/> A. 十三级等级制 Letter Grading <input type="checkbox"/> B. 二级记分制（通过/不通过） Pass/Fail Grading

课程审批 REVIEW AND APPROVAL

21. 本课程设置已经过以下责任人/委员会审议通过
This Course has been approved by the following person or committee of authority

物理系教学指导委员会 Education Instruction Committee of Physics department

