

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.

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| 1. | 课程名称 Course Title | 直线加速器关键技术 Key Technologies of linear accelerator |
| 2. | 授课院系 Originating Department | 物理系 Department of Physics |
| 3. | 课程编号 Course Code | PHYS302 |
| 4. | 课程学分 Credit Value | 1 |
| 5. | 课程类别 Course Type | 专业选修课 Major Elective Courses |
| 6. | 授课学期 Semester | 夏季 Summer |
| 7. | 授课语言 Teaching Language | 中文 Chinese |
| 8. | 授课教师、所属学系、联系方式 (For team teaching, please list all instructors) Instructor(s), Affiliation & Contact | 邵佳航 先进光源科学中心 Jiahang Shao, Center for Advanced Light Source shaojiahang@mail.iasf.ac.cn |
| 9. | 实验员/助教、所属学系、联系方式 Tutor/TA(s), Contact | 无 NA |
| 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 | 16 | 0 | 0 | 0 | 16 |
| 12. 先修课程、其它学习要求 Pre-requisites or Other Academic Requirements | 无 NA | | | | |
| 13. 后续课程、其它学习规划 Courses for which this course is a pre-requisite | 无 NA | | | | |
| 14. 其它要求修读本课程的学系 Cross-listing Dept. | 无 NA | | | | |

教学大纲及教学日历 SYLLABUS

15. 教学目标 Course Objectives

直线加速器是直线对撞机、自由电子激光、小型工业及医疗加速器的基础。本课程将教授直线加速器基本原理，介绍束流物理、电子枪、加速器结构、束流测量技术等基本概念，并以正在研制中的深圳中能高重复频率 X 射线自由电子激光装置为例介绍大型自由电子激光光源所用的直线加速器。

Linear accelerator is the base of linear collider, free electron lasers, and industrial/medical accelerators. This course will focus on the fundamentals of linear accelerators, including beam physics, electron guns, accelerating structures, beam diagnostics, etc. This course will introduce state-of-the-art linear accelerators in free electron laser facilities with an example of Shenzhen superconducting soft X-ray free electron laser under development.

16. 预达学习成果 Learning Outcomes

通过本课程的学习，学生应掌握以下粒子加速器基础知识：束流物理、光阴极微波电子枪、常温及超导加速结构、尾场结构、束流测量。

After completion of this course, students are expected to understand the following fundamentals of linear accelerators: beam physics, photocathode RF gun, normal conducting and superconducting accelerating structures, wakefield structures, and beam diagnostics.

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.)

本课程将分为八讲，具体内容如下。

This course consists of eight lectures.

第一讲：课程介绍、加速器简介

Lecture 1: Brief introduction to particle accelerators

第二讲：直线加速器中的束流物理

Lecture 2: Beam dynamics in linear accelerators

第三讲：光阴极微波电子枪

Lecture 3: Photocathode RF gun

第四讲：常温加速结构

Lecture 4: Normal conducting accelerating structures

第五讲：超导加速结构

Lecture 5: Superconducting accelerating structures

第六讲：尾场结构

Lecture 6: Wakefield structures

第七讲：束流测量技术

Lecture 7: Beam diagnostics

第八讲：S3FEL 设计实例 - 直线段

Lecture 8: S3FEL – linear accelerator

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

赵振堂 等，先进 X 射线光源加速器原理与关键技术，上海交通大学出版社，2020 年第一版

Zhentang Zhao et al., Principles and Key Technologies of Advanced X-ray Light Source Accelerators, Shanghai Jiao Tong University Press, 2020 first edition

课程评估 ASSESSMENT

| 19. 评估形式 Type of Assessment | 评估时间 Time | 占考试总成绩百分比 % of final score | 违纪处罚 Penalty | 备注 Notes |
|--------------------------------|--------------|-------------------------------|-----------------|-------------|
| 出勤 Attendance | | 20 | | |
| 课堂表现 Class Performance | | | | |
| 小测验 Quiz | | | | |
| 课程项目 Projects | | | | |
| 平时作业 Assignments | | | | |
| 期中考试 | | | | |

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|---|--|----|--|---|
| Mid-Term Test | | | | |
| 期末考试 Final Exam | | | | |
| 期末报告 Final Presentation | | 80 | | 任选一个直线加速器装置完成调研报告 Complete a research report of a linear accelerator |
| 其它（可根据需要 改写以上评估方式） Others (The above may be modified as necessary) | | | | |

20. 记分方式 **GRADING SYSTEM**

- A. 十三级等级制 **Letter Grading**
 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

