

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	空间科学与技术基础 Fundamentals of Space Science and Technology
2.	授课院系 Originating Department	地球与空间科学系 Department of Earth and Space Sciences
3.	课程编号 Course Code	ESS210
4.	课程学分 Credit Value	3
5.	课程类别 Course Type	专业核心课 Major Core Courses
6.	授课学期 Semester	春季 Spring
7.	授课语言 Teaching Language	中英双语 English & Chinese
8.	授课教师、所属学系、联系方式 Instructor(s), Affiliation & Contact (For team teaching, please list all instructors)	杨剑, 地球与空间科学系 邮箱: yangj36@sustech.edu.cn 电话: 0755-88018694 办公室: 创园9栋411 Jian Yang, Department of Earth and Space Sciences Email: yangj36@sustech.edu.cn Tel: 0755-88018694 Office: Innovation Park #9-411
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				48
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					
14. 其它要求修读本课程的学系 Cross-listing Dept.					

教学大纲及教学日历 SYLLABUS

15. 教学目标 Course Objectives

本课程讲授太阳系内与空间等离子体有关的物理现象与原理, 以及相关空间探测技术的原理。结合理论描述和观测事实, 介绍太阳、太阳风、行星磁层以及电离层中各尺度的物理过程以及它们之间的相互作用, 为后续专业课程(例如磁层物理学、电离层物理学等)的学习提供必要的基础知识。

This course is one of the core courses for space physics. It covers virtually all aspects of space plasmas in the solar system. Combining theory and observations, the course introduces the basic phenomena related to the Sun, solar wind, planetary magnetospheres, ionospheres, and their interactions. It also includes the fundamentals of space exploration techniques. It aims to prepare students for further study of advanced courses.

16. 预达学习成果 Learning Outcomes

学生完成本课程后, 将会掌握以下知识:

1. 太阳的基本结构; 太阳大气、太阳风和行星际磁场的性质和起源;
2. 地球磁层的基本结构、动力学过程和研究方法;
3. 地球电离层的基本结构、动力学过程和研究方法;
4. 日地空间系统和空间天气;
5. 太阳系其他星体的磁层和电离层;
6. 空间探测技术的基本原理。

Upon completing the course, students will acquire the following knowledge:

1. The structure of the Sun and the solar atmosphere, the origin and the properties of the solar wind and the interplanetary magnetic field;
2. The structure of Earth magnetosphere, its dynamics and methodology;
3. The structure of Earth ionosphere, its dynamics and methodology;
4. The heliosphere and space weather;
5. The magnetosphere and ionosphere of other planets;
6. The fundamentals of space exploration techniques.

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.)

第一章：课程简介和空间等离子体物理基础（4 学时）

介绍等离子体物理的基本概念，物理原理和主要性质。

第二章：太阳（4 学时）

太阳的物理性质和内部结构。

第三章：太阳风、行星际磁场和日球层（4 学时）

太阳大气的主要结构和周期性；太阳风和行星际磁场的性质；行星际激波；日球层的结构；太阳风探测和日球层探测历史与技术。

第四章：宇宙线（4 学时）

行星际空间的高能粒子，传播方程；银河宇宙线。

第五章：太阳风和行星的相互作用（6 学时）

弓激波的性质和形成原因、磁层形状和及其数学描述；磁重联探测简介。

第六章：地球磁层的结构（6 学时）

地球磁层中的粒子分布、磁场结构、电流体系等。

第七章：地球磁层中的波动（4 学时）

磁脉动、等离子体波、磁流体波；以及地球磁层中不同的位置的波的特点。

第八章：地球磁层中的磁暴和亚暴（4 学时）

磁层和电离层的耦合；地球磁暴和亚暴的主要现象、过程和模式；磁层探测历史与基础。

第九章：地球的电离层和高层大气（4 学时）

电离层和高层大气的结构和动力学过程。

第十章：空间天气（4 学时）

太阳活动对地球磁场和电离层的影响以及主要的空间天气现象。

第十一章：太阳系其他星体的磁层和电离层（4 学时）

行星际空间的磁化和非磁化星体。

Chapter 1: Introduction and basics of the space plasma physics (4 hours)

Course introduction; the concept and the physics of the space plasma

Chapter 2: The Sun (4 hours)

The interior structure of the Sun; the energy source

Chapter 3: The solar wind, interplanetary magnetic field and heliosphere (4 hours)

The solar atmosphere; the periodicity of solar activity, the structure and properties of the solar wind and interplanetary magnetic field; the shape of the heliosphere; measurement of the solar wind and exploration of the edge of the heliosphere

Chapter 4: Cosmic rays (4 hours)

Energetic particles in the interplanetary space; cosmic rays

Chapter 5: Solar-wind interactions with magnetized planets (6 hours)

The shape and size of the magnetospheric cavity; bow shock; measurement of magnetic reconnection

Chapter 6: Earth's magnetosphere (6 hours)

Structure of Earth's magnetosphere, distribution of plasma and fields

Chapter 7: Waves in Earth's magnetosphere (4 hours)

Pulsations, plasma waves, MHD waves, and waves in different regions in Earth's magnetosphere

Chapter 8: Geomagnetic storms and substorms (4 hours)

Magnetosphere-ionosphere coupling; the process of geomagnetic storms and substorms, their dynamics and models; history and fundamentals of magnetospheric exploration

Chapter 9: Earth's ionosphere and upper atmosphere (4 hours)

Structures and dynamics of Earth's ionosphere and upper atmosphere

Chapter 10: Space weather (4 hours)

Effects of the solar activity on Earth's magnetosphere and ionosphere; space weather phenomena

Chapter 11: Magnetosphere and ionosphere on other planets (4 hours)

Structures and characteristics of the magnetosphere and ionosphere on other planets

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

1. Introduction to Space Physics, Margaret G. Kivelson, Christopher T. Russell, Cambridge University Press, 1995/04/28
2. Space physics, Christopher T. Russell, Janet G. Luhmann, Robert J. Strangeway, Cambridge University Press, 2016.
3. 涂传诒等, 日地空间物理学(上下册), 科学出版社, 1988.

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				
课堂表现 Class Performance		5		
小测验 Quiz				
课程项目 Projects				
平时作业 Assignments		20		
期中考试 Mid-Term Test		30		
期末考试 Final Exam		45		
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)				

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

地球与空间科学系本科教学指导委员会
Undergraduate Teaching Steering Committee of the Department of Earth and Space Sciences