

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	基础天文学 Fundamentals of Astronomy
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	ESS204
4.	课程学分 Credit Value	3
5.	课程类别 Course Type	专业选修课 Major Elective 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 (For team teaching, please list all instructors)	田振粮，地球与空间科学系 邮箱: tianzl@sustech.edu.cn 办公室: 创园 9 栋 310 室 ZhenLiang Tian, Department of Earth and Space Sciences E-mail: tianzl@sustech.edu.cn Office: Innovation Park #9-310
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	46	2			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

本课程的目标是对宇宙中各类天体的物理、化学特征与规律作系统全面的介绍。这首先包括了从小行星到气态大行星、系外行星的这个行星际的世界，其次包括了太阳与白矮星、黑洞等恒星世界，还包括了从太阳系、银河系、本星系群等不同层次物质成团结构，最后还包括了时间与空间的性质。本课程就是要使学生对人类关于宇宙的知识有一个总体的了解和掌握。

This course is to make a comprehensive introduction to the physical and chemical features of various celestial bodies and the laws concerning their motion and evolution. This includes, first, the planetary worlds ranging from asteroids to gas giants; second, the starry world from our Sun to white dwarfs and black holes; third, various scales of clustering of matter in the universe, ranging from our Solar system to our galaxy Milky Way to the local group; and fourth, the properties of space and time. In short, this course is aimed at helping students gain an integrated view of human's knowledge about the universe.

16. 预达学习成果 Learning Outcomes

学生学习完本课程后，预计将会了解、掌握以下知识：

1. 对地球、月球起源问题的物理、化学约束条件；
2. 类地行星与气态大行星的结构、物质组成，太阳系形成与演化；
3. 恒星演化与元素合成；
4. 时空性质、引力性质与宇宙物质分布。

Upon completing the course, the students are expected to gain knowledge/skills in the following fields/topics:

1. the physical and chemical constraints on the formation and evolution of the Earth-Moon system;
2. the structure and composition of terrestrial planets and gas giants, and the formation and evolution of the Solar system;
3. evolution of stars and origin of elements;
4. relativistic properties of space-time and gravitation, and models of distribution of matter in the universe.

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 概论（2 学时）

介绍天文学的发展历史，中国古代天文学的成就

第二章 地球-月球系统（4 学时）

介绍地-月形成过程的研究进展，以及对月球起源问题的物理化学约束

第三章 太阳系的组成、形成与演化（5 学时）

着重介绍各类陨石中的地球化学信息对于太阳系早期历史的研究意义

第四章 天体的动力学演化（6 学时）

介绍太阳系中的轨道共振、自旋-轨道耦合、卡西尼态等动力学现象

习题（1 小时）

第五章 大行星、柯伊伯带天体（4 学时）

介绍木星、土星等气态大行星，以及柯伊伯带(Kuiper belt)的发现及天体分布

第六章 系外行星（4 学时）

系外行星的探测

第七章 天体测距（4 学时）

介绍三角视差法、造父变星法、光度法等测距方法

第八章 天体的年龄（4 学时）

介绍用多种方法(如同位素方法、赫罗图方法)对天体定年

第九章 恒星演化（4 学时）

介绍赫罗图，及恒星在不同阶段的形态与能量过程

第十章 宇宙的物质分布与运动（5 学时）

介绍奥伯斯佯谬，不同尺度上天体的成团特征，哈勃关系，宇宙膨胀与收缩

第十一章 相对论与天体运动（4 学时）

介绍狭义相对论的时空关系、广义相对论的引力观念，及其对天体运动的描述

习题（1 小时）

Chapter 1 Introduction (2 hours)

History of astronomy, with special discussion on ancient Chinese astronomical achievements.

Chapter 2 The Earth-Moon system (4 hours)

Constraints on the origin of the Moon, and advances in the study of the formation of the Earth-Moon system.

Chapter 3 Solar system: its composition, formation and evolution (5 hours)

With special treatment on the geochemical information in meteorites and its bearing on the study of the early history of the Solar system.

Chapter 4 Dynamical evolution of celestial bodies (6 hours)

Dynamical phenomena in the Solar system, such as mean motion resonances, spin-orbit coupling, and the Cassini states.

Exercise Lesson (1 hour)

Chapter 5 Gas giants and the Kuiper belt (4 hours)

Formation, composition and structure of gas giants like Jupiter and Saturn, and discovery and dynamical distribution of the Kuiper belt.

Chapter 6 Exoplanets (4 hours)

Detection and characters of exoplanets.

Chapter 7 Measurement of distances (4 hours)

Distance measurements using methods such as trigonometry and variable stars.

Chapter 8 Ages of celestial bodies (4 hours)

Measurement of ages of bodies using methods such as radiochronology and reading the Hertzsprung diagram.

Chapter 9 Evolution of stars (4 hours)

The states and energy budgets of stars in different phases.

Chapter 10 Distribution and motion of matter in the universe (5 hours)

Olbers' paradox, Hubble's constant and the dynamical features of the universe.

Chapter 11 Relativity and motion of celestial bodies (4 hours)

The space-time relation in special relativity, the concept of gravitation in general relativity, and the corresponding dynamical solutions of celestial bodies.

Exercise Lesson (1 hour)

1. 向守平, 天体物理概论, 中国科学技术大学出版社, 2008
2. Imke de Pater, Jack J. Lissauer, Planetary Sciences 2nd Edition, Cambridge University Press, 2015

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		10		
课堂表现 Class Performance				
小测验 Quiz		10		
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		30		
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