

National Cheng Kung University

Modular Course 2021 Summer Program

電漿基礎理論與實作

Introduction to plasma theory and demonstration

Instructor

Affiliation

Graduation (Ph.d.)

張博宇

NCKU

Institute of Space and Plasma
Sciences

University of Rochester

Course
Type

Course
Credit

Student Size
(Maximum)

Lecture
+
Recitation

1

20

因應 COVID-19 疫情，本課程改以線上授課。

Student Background

College of Science、College of Engineering、College of Bioscience and Biotechnology、College of Electrical Engineering & Computer Science、College of Medicine

Difficulty

Challenging Medium Well Medium Entry Level (Basic)

Format of The Course

Lecture 80% , Experiment 20%

Grading Policy

Participation 25%、Science report 75%

Note:

Students need to choose a subject related to the content of the course for their scientific report. They need to describe the theory and the principles of the applications or the phenomenon. The purpose is to review the students' understanding in plasma. Also, it is to train students to write reports. Students need to hand in their report within one week after the end of the course.

補充說明：

科學報告學生需自行挑選一個與課程內容相關的主題，描述該主題之理論基礎及應用原理，目的檢視學生課堂中了解狀況，並練習撰寫報告，學生於課程結束後一週內繳回。

Code of Conduct for The Course

遵守實驗安全規範；不遲到早退。因為演示實驗會有高壓，不得穿拖鞋或涼鞋。

Following laboratory safety roles. Do not come late nor leave earlier. High voltage will be used in the demonstration experiments, no slippers nor sandals are allowed in class.

Course Description

(1) Introduction to basic knowledge of plasma physics: plasma is a complex system. It is important to have the basic knowledge for working on applications. Therefore, this course will use 18 hours of course time to introduce (1) the definition and characteristics of plasma, and (2) the various ways and applications of plasma generation.

(2) Demonstration of generating plasma: by directly seeing the phenomenon of plasma, students can understand the meaning of plasma theory more intuitively and can appreciate the wider application

National Cheng Kung University

Modular Course 2021 Summer Program

value of plasma. Depending on the application, the method of generating plasma is different. Therefore, we will use 5 classes of course time to demonstrate different methods of generating plasma, including (1) (magnetron) DC high-voltage discharge plasma, and (2) magnetic mirror plasma control system (AC capacitively coupled plasma), (3) Planeterella aurora simulator, (4) dielectric barrier discharge plasma.

(一) 介紹基本的電漿物理知識：電漿為一複雜系統，需要有基本的概念才能在實務上有幫助。因此，本課程將利用 18 小時的課程時間，介紹(1)電漿的定義及特性、(2)產生電漿的各種方式及應用。

(二) 產生電漿的演示實驗：透過直接觀察電漿現象的方式，能讓學生能更直觀的了解電漿理論的意義，更能體會電漿廣泛的應用價值。基於不同的應用，產生電漿的方式亦不同。因此，本計畫將利用 5 堂的課程時間，演示不同產生電漿的方式，包括(1) (磁化)直流高壓放電電漿、(2)磁力鏡電漿控制系統(交流電感式感應放電電漿)、(3) Planeterrella 極光模擬器、(4) 介電質放電大氣電漿。

Timetable and Syllabus

Peroid	Timetable	Syllabus
7/26(一)	14:00 - 15:30	介紹(1)電漿的定義及特性；(2)產生電漿的方式。 Introduce (1) the definition and characteristics of plasma; (2) how plasma is generated.
	15:30 - 17:40	以影片演示實驗：(磁化)直流高壓放電電漿 Demonstration via video: (Magnetron) DC discharge plasma
7/27(二)	14:00 - 15:30	介紹半導體製程中所使用的電漿特性。 Introduce the characteristics of plasma in the production process of semiconductor fabrication.
	15:30 - 17:40	以影片演示實驗：磁力鏡電漿控制系統(交流電感式感應放電電漿) Demonstration via video: Magnetic mirror system using AC capacitively coupled plasma
7/28(三)	14:00 - 15:30	核融合介紹 Introduction to nuclear fusion as the energy source.
	15:30 - 17:40	介紹(1)太空環境中的電漿；(2) 電漿尾場電子加速器；(3) 電漿推進器。 Introduce (1) plasma in space; (2) plasma wake-field accelerator; (3) plasma thruster.
7/29(四)	14:00 - 15:30	以影片演示實驗：Planeterrella 極光模擬器 Demonstration via video: Planeterrella as the aurora simulator.
	15:30 - 17:40	介紹(1) 實驗天文/太空科學；(2) 極紫外光光源。 Introduce (1) Laboratory astrophysics and space sciences; (3) EUV light source.
7/30(五)	14:00 - 15:30	以影片演示實驗：介電質放電大氣電漿 Demonstration via video: Dielectric barrier discharge plasma
	15:30 - 17:40	介紹(1)電漿的定義及特性；(2)產生電漿的方式。 Introduce (1) the definition and characteristics of plasma; (2) how plasma is generated.

National Cheng Kung University

Modular Course 2021 Summer Program

Goal of the Course

1. 讓學生在理論基礎上對電漿有所了解。
Let students understand the basic theory of plasma.
2. 讓學生在實務上觀察到不同產生電漿的方式。
Let students see different ways of generating plasma.
3. 讓學生體會電漿廣泛的應用價值。
Let students see various applications of plasma.

The Importance, Cross-Over Disciplinary and Contemporary of The Curriculum

完整性：課程將介紹電漿，配合實驗，讓修課學生有足夠的電漿基本知識踏入相關領域。

聚焦性：實驗部份將著重於電漿產生，讓學生了解因應不同應用時可使用的產生電漿之方法。

跨域性：電漿已應用在許多不同的領域，學生透過對電漿的基本了解後，可依興趣往不同的應用領域深入學習。

當代性：透過對電漿的了解，學生更容易了解當代的各種電漿應用技術。

Completeness: The course will introduce plasma in theory and in experiments. Students will learn the basic knowledge of plasma so that they can enter different plasma related fields easily.

Focus: Experiments will focus on demonstrating different ways of generating plasma so that students know how to determine the ways of generating plasma depended on the applications.

Interdisciplinary: Plasma has been applied in many fields. Depended on students' interests, they can study advanced knowledge in plasma for different applications.

Contemporary: Through the understanding of plasma, students can understand more easily various plasma technologies that are currently used.

Remarks

References :

講義

Notes