

# 理學院

## 109 學年度第二學期模組化課程

電漿量測之蘭摩爾探針原理與實作

Theory and demonstration of plasma measurement using Langmuir probe

授課教師

任職單位

畢業學校

張博宇

國立成功大學  
太空與電漿科學研究所

美國羅徹斯特大學

課程類別 學分數 選必修 開課人數 其他注意事項

Lecture  
+  
Recitation 1 選修 12 本課程為英文授課

先修課程或先備能力：

無

課程難易度：

難  中偏難  中偏易  易

建議修課學生背景：

理學院、工學院、生科院、電資學院、醫學院

教學方法：

講授 40%、實驗 60%

評量方式：

科學報告 50%、實作產品/作品 25%、實驗操作 25%

補充說明：

- (i) 實驗操作評分依據：於第五天課堂中實際測試探針是否可以正常運作。
- (ii) 實作產品/作品：於第四天課堂結束時檢查探針完成度
- (iii) 科學報告：報告需描述蘭摩爾探針之理論基礎及應用原理、探針製作流程、操作流程、數據分析及討論等，學生於課程結束後一週內繳回。

Notes:

- (i) Grades in usability of the Langmuir probe: on the fifth day, students need to show the Langmuir probe they build can work properly.
- (ii) Grades in building the Langmuir probe: by the end of the class on day 4, students need to show the Langmuir probe they build.
- (iii) Scientific report: the report should describe the theory and the application principle of the Langmuir probe, the process of building the probe, the procedure of using the probe, data analysis and discussions, etc. Students need to hand in their report within one week after the end of the course.

學習規範：

不遲到早退

# 理學院

## 109 學年度第二學期模組化課程

### 課程概述：

- (一) 介紹基本的電漿物理知識：電漿為一複雜系統，需要有基本的物理概念才能在實務上有幫助。因此，本課程將利用 3.5 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) 介紹蘭摩爾探針：蘭摩爾探針被廣泛使用於業界、核融合、太空量測。因此，本課程將利用 3.5 小時的課程時間介紹其原理及應用。
- (三) 蘭摩爾探針實作：將學生分組，每組利用 7 小時的課程時間讓學生親手製作蘭摩爾探針。
- (四) 電漿量測實作：利用 3.5 小時的課程時間，透過直流高壓放電方式展示電漿如何產生，並利用學生製作出的蘭摩爾探針實際量測電漿之密度及溫度，透過實驗操作了解學術研究或工業應用中之電漿參數是如何量測的。

### 課程概述(英文)：

- (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 3.5 hours of course time to introduce (a) the definition and characteristics of plasma, and (b) the various ways and applications of plasma generation.
- (2) **Introduction to Langmuir Probes:** Langmuir probes are widely used in the industry, nuclear fusion, and space measurement. Therefore, this course will use 3.5 hours of course time to introduce its principles and applications.
- (3) **Implementation of Langmuir probes:** students will be grouped in groups. Each groups will use 7 hours of course time to build Langmuir probes by themselves.
- (4) **Plasma measurements:** in 3.5 hours of course time, we will assist students to generate plasma using DC high voltage discharge method. Students will measure the density and the temperature of plasma using the Langmuir probes they build. Through experiments, students will learn how plasma parameters are measured in academic research or industrial applications.

### 課程進度：

堂次	時間	進度說明
2021/1/18(一)	14:00 - 17:35	講授：電漿理論及應用之介紹 Lecture: theories and applications of plasma.
2021/1/19(二)	14:00 - 17:35	講授：蘭摩爾探針之原理 Lecture: theory of Langmuir probes.
2021/1/20(三)	14:00 - 17:35	實作：蘭摩爾探針之製作 1 Implementation: building the Langmuir probe 1.
2021/1/21(四)	14:00 - 17:35	實作：蘭摩爾探針之製作 2 Implementation: building the Langmuir probe 2.
2021/1/22(五)	14:00 - 17:40	實作：直流高壓放電電漿及電漿量測實作 Implementation: plasma measurements of DC discharge plasma using the Langmuir probe students build.

# 理學院

## 109 學年度第二學期模組化課程

### 課程學習目標：

1. 讓學生對電漿理論及應用有所了解。

Let students understand the basic theory and applications of plasma.

2. 讓學生了解蘭摩爾探針的原理。

Let students understand the basic theory of a Langmuir probe.

3. 讓學生體驗蘭摩爾探針的使用方式。

Let students understand how a Langmuir probe is used.

### 課程的重要性、跨域性與時代性：

#### 完整性：

課程將介紹電漿及蘭摩爾探針，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：

實驗部份將著重於製作及使用蘭摩爾探針來量測電漿之密度與溫度特性，讓學生了解蘭摩爾探針之原理及應用。

#### 跨域性：

電漿已應用在許多不同的領域，學生透過製作蘭摩爾探針了解如何量測電漿特性後，可依興趣往不同的應用領域深入學習。

#### 當代性：

透過對電漿及蘭摩爾探針的了解，學生更容易了解當代的各種電漿應用技術。

#### Completeness:

The course will introduce the basic knowledge of plasma and Langmuir probes. Students will learn the basic knowledge of plasma so that they can enter various plasma related fields easily.

#### Focus:

Experiments will be focused on how the Langmuir probe is built and how the density and temperature characteristics of the plasma are measured using the Langmuir probe. It is to help students understand the theory and applications of Langmuir probes.

#### Interdisciplinary:

Plasma has been applied in many fields. Depending on students' interests, they can study advanced knowledge in plasma for different applications after knowing how to measure characteristics of plasma using the Langmuir probe.

#### Contemporary:

Through the understanding of plasma and Langmuir probe, students can understand more easily various plasma technologies that are currently used.

### 其他備註：

#### 參考書目：

講義

Notes