

Course Title: “**Plasma Physics**”
“離子體物理” (PHYS 535)

Teacher: Prof. **Tsun-Hsu Chang** (張存續)

Department of Physics, National Tsing Hua University, Taiwan
Rm. 417, Tel. 42978, E-mail: thschang@phys.nthu.edu.tw

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1. Description: Plasma Physics is an extension of Electrodynamics. We will start with the introduction of plasma, followed by the single-particle motion, and then discuss the Vlasov equation with the knowledge of complex variables and contour integration. Mathematical capability and high-level knowledge of plasma physics will be covered. The aim of the course is to cultivate students to have independent learning capability and presentation capability.

2. Textbook: Dwight R. Nicholson, “Introduction to Plasma Theory” Chapters 1, 2, 6, and 7 (supplemented by Special Topic(s)).

3. Principal References:

- Umran S. Inan and Marek Golkowski, “Principles of Plasma Physics for Engineers and Scientists”;
- Krall and Trivelpiece, “Principles of Plasma Physics”;
- E. Kreyszig, "Advanced Engineering Mathematics";
- J. D. Jackson, “Classical Electrodynamics”.

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4. Time: Wednesdays W2W3W4 (9:00-10:20 & 10:30-11:40). 150 min will be used for lecturing. Others may be used for Q&A, etc.

5. Classroom: Physics Building R501

6. Conduct of Class: The course is [offered in English](#), but important physical concepts may be reiterated in Chinese. Students have to go through the math in the lecture notes before attending classes. Questions are strongly encouraged.

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7. Grading Policy: Midterm and final oral presentations (50%×2); Class participation (5% extra) ~~and attendance~~. The overall score will be normalized to reflect an average consistency with other courses.

Week	Date	Content
1	02/24	Introduction & Chap.1 Introduction
2	03/03	Chap.1
3	03/10	Chap.1
4	03/17	Chap.2 Single Particle Motion & PowerPoint preparation guideline
5	03/24	Chap.2
6	03/31	Chap.6
7	04/07	Intercollegiate activities (No class)Chap.6 Vlasov Equation
8	04/14	Chap.6
9	04/21	Oral presentation
10	04/28	Chap.6
11	05/05	Chap.6
12	05/12	Chap.6
13	05/19	Chap.7 Fluid Equations
14	05/26	Special Topic I: The Electron Cyclotron Maser
15	06/02	Special Topic II: Gain and Bandwidth
16	06/09	Oral presentation
17	06/16	Special Topic III: Plasma Applications
18	06/23	Make-up if needed

* This table is for your reference only. The practical schedule depends on the students' learning condition.

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8. Lecture Notes:

The first three chapters of the lecture notes come from Nicholson and then follow by two selected topics, all starting from basic equations.

As in Nicholson, we adopt the Gaussian unit system. The conversion between different unit system can be found in Jackson.

Equations numbered in the format of (1.1), (1.2)... refer to Nicholson. Supplementary equations derived in lecture notes, which will later be referenced, are numbered (1), (2)... [restarting from (1) in each chapter.] Equations in Appendices A, B...of each chapter are numbered (A.1), (A.2)...and (B.1), (B.2)...

Page numbers cited in the text (e.g. p. 120) refer to Nicholson.

Section numbers (e.g. Sec. 1.1) refer to Nicholson. Main topics within each section are highlighted by **boldfaced** characters. Some words are typed in *italicized* characters for attention. Technical terms which are introduced for the first time are underlined.

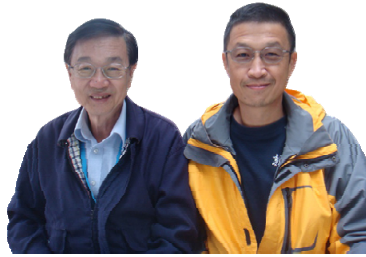
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9. Core capabilities: to be cultivated by this course :

- 物理相關數學能力 Mathematical capability in physics (25%)
- 高階物理知識 High level knowledge of physics (25%)
- 自主學習能力 Independent learning capability (20%)
- 溝通表達能力 Capability of communication and expression (30%)

10. Course keywords: plasma frequency, single particle motion, Vlasov equation, magnetized plasma, instability, electron cyclotron maser.

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Special thanks to Prof. Kwo-Ray Chu (朱國瑞), who provided the original version of the lecture note. Professor Kwo-Ray Chu taught me Plasma Physics 20+ years ago.

朱國瑞教授曾獲得之學術榮譽

- Fellow, American Physical Society (1983)
- 國科會物理傑出研究獎 (1986-1995, 共五屆)
- 中華民國物理學會第一屆會士 (1994)
- 教育部第一屆國家講座 (1997)
- Fellow, Institute of Electrical and Electronics Engineers (IEEE) (1997)
- 2001 IEEE Plasma Science and Application Award (IEEE Nuclear and Plasma Sciences Society)
- 2001 K.J. Button Medal and Prize (Institute of Physics, Great Britain)
- 教育部理科學術獎 (2002)
- 中央研究院院士 (2002)
- 中華民國總統科學獎 (2003)
- 行政院傑出科技榮譽獎 (2004)
- 斐陶斐榮譽學會傑出成就獎 (2006)
- 臺灣大學傑出校友 (2007)
- 國科會五十科學成就 (2009)

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