

超快光學-課程大綱

(11010 IPT 543000, Ultrafast Optics)

一、課程說明(Course Description)

本課程旨在介紹超短(10^{-12} ~ 10^{-15} 秒)雷射光脈衝之產生、量測、傳播、色散管理、及其應用。此一技術提供的超精密時間解析度可用以觀測前所未知的短暫粒子動態。所產生之巨大尖峰亮度($>10^{22}$ W/cm²)足以突破原子基本引力，或驅動物質產生顯著之非線性效應，從而獲得一系列新的(如中紅外光、極紫外光)同調光譜成份。本課程所需要的先備能力為：傅立葉轉換、電磁平面波，並具備運用數學軟體(如 Matlab)之能力。

二、預期學習成果(Intended Learning Outcomes)

1. Justify the principle of pulse formation in time and frequency domains.
2. Justify the roles of elements and design rules of a Kerr-lens mode-locked laser.
3. Retrieve the complex envelope of a short pulse from a spectrogram.
4. Compensate the pulse chirp by a grating pair numerically.
5. Interpret the following terms: mode locking, saturable absorber, self-phase modulation, dispersion, chirp, intensity autocorrelation, spectrogram, angular dispersion.

三、教材(Teaching Materials)

自編講義(Lecture slides, pdf files will be offered at the beginning of semester.)

Andrew Weiner, *Ultrafast Optics*, Wiley, 2009. (ISBN: 978-0-471-41539-8)

四、教學方式(Teaching Method)

開放式課程影片預習、隨堂討論及問答、課堂補充講授、團隊專題 (OpenCourseWare video preview, discussion and Q&A in class, lectures, team projects)

五、教學進度(Syllabus)

1. Introduction and review
2. Active mode-locking
3. Light-matter interaction
4. Passive mode-locking
5. Pulse measurement by correlation techniques
6. Pulse measurement by FROG and SPIDER
7. Dispersion and dispersion management
8. Flexible topics depending on request
9. Team projects

六、成績考核(Evaluation)

教師考核(20%)，期中考(20%)，期末考(30%)，團隊專題(20%)，作業(10%)

七、可連結之網頁位址

數位學習平台：<https://eeclass.nthu.edu.tw/login/index.php>

開放式課程：<http://ocw.nthu.edu.tw/ocw/index.php?page=course&cid=206&>

遠距教學連結：<https://meet.google.com/ona-tvew-rvb>（開放線上電子加簽）