Phys597001 **Special Topics in Physics:**
Ultrafast and THz Photonics

Lecture Hours: 18:20 – 21:10, Mondays
Location: Room Phys 313
Instructor: Prof. Ci-Ling Pan (潘犀靈教授)

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Office Hours: by appointment

Course Objective:

This course intends to prepare students so that they are ready for work in the modern photonics laboratories with ultrafast photonic and THz tools or to understand and evaluate the research of others working in the field of ultrafast and THz photonics. Selected hot topics in these areas will also be reviewed.

Course Contents:

- Introduction;
- Laser basics;
- Generation of Ultrashort Laser Pulses;
- Linear and Nonlinear Pulsed Optics;
- Characterization of Laser Pulses;
- Manipulation and Control of Laser Pulses;
- Ultrafast Spectroscopic Techniques;
- Ultrafast Optoelectronics;
- Terahertz Science and Technology;
- Selected hot topics in Ultrafast and THz Photonics.

There is no specific textbook. Please consult references below. **We will heavily utilize Prof. Trebino's course material on Ultrafast Optics, please surf and download materials from his website (see web resources below)**.

References:

1. R. Trebino, *Frequency Resolved Optical Gating: The measurement of ultrashort laser pulses*, Kluwer Academic Publishers, 2002.

2. C. Rulliére, Ed., *Femtosecond Laser Pulses: Principles and Experiments*, 2nd ed., Springer, 2005 (available as e-book).
3. J. C. Diels and W. Rudolph, *Ultrashort Laser Pulse Phenomena: Fundamentals, Techniques, and Applications on a Femtosecond Time Scale*, Burlington, MA: Academic Press, 1st ed., 1996, 2nd. ed., 2006 (available as e-book).
4. D. Mittleman, ed., *Sensing with THz radiation*, Spring-Verlag, New York, 2002.
5. Kiyomi Sakai (Ed.), *Terahertz Optoelectronics*, Springer, 2005 (available as e-book).
6. Yun-Shik Lee, *Principles of Terahertz Science and Technology*, Springer, New York, 2008 (available as e-book).
7. A. E. Siegman, *Lasers*, University Science Books, Mill Valley, CA, 1986.
8. Current literature

Pre-requisites:

Undergraduate electromagnetic theory; modern physics or elementary quantum mechanics; undergraduate applied or engineering mathematics. Prior exposures to optics or lasers are helpful.

Grading

Grades will be determined by incidental problem sets, a term paper with presentation, and class participation. The formula that will be used to calculate your final grade is:

Problem Sets: 40%
Term Paper: 40%
Class Participation: 20%

Resources on the Web:

1. Prof. Trebino's course website: http://www.physics.gatech.edu/gcuo/UltrafastOptics/
2. Prof. F. Kartner's course material on Ultrafast Optics, available as MIT Open Course Ware, http://ocw.mit.edu/OcwWeb/Electrical-Engineering-and-Computer-Science/6-977Spring-2005/CourseHome/index.htm
3. Virtual Journal of Ultrafast Science, http://www.vjultrafast.org/
4. Virtual Journal of THz Science and Technology , http://www.thznetwork.org/wordpress/index.php/vj/