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IPT 591300 Relativistic Photonics – free-electron laser

Spring 2014
Class location: EECS 205., Class schedule: T2T3R4

Primary lecturer

Prof. Yen-Chieh Huang, Institute of Photonics Tech.,/Department of Electrical Engineering, NTHU

Teaching Assistant: Hossein Shirvani, x 62333

This course is meant to establish a background for graduate students who intend to understand or conduct research on relativistic photonics. To establish the basic concept of this course, the first part of the class will start with the understanding of laser plasma and electron optics. We will then continue the lectures on relativistic electrodynamics and particle radiation. With enough background knowledge, we will look into the physics of various types of free-electron lasers, including Cherenkov, Smith-Purcell, backward-wave oscillator, undulator FELs etc. Each student in this class must give presentations, ask questions, and join discussions based on weekly reading assignments. In the end of the semester, each student has to submit a term report, including the review of papers and extending the ideas in the papers into advanced research results.

Course Content

1. Introduction to laser plasma
2. Particle Optics
3. Relativistic Electrodynamics
4. Particle Radiation
5. Relativistic Electron Beam
6. Cherenkov-type FEL- I
7. Cherenkov-type FEL – II
8. Undulator FEL – I
9. Undulator FEL – II
10. High-gain FEL

Term Report

1. March 18th, submit the title of report report
2. April 22nd, submit the outline of the term report, including 5 sub-sections each containing 1 paragraph of descriptions.
3. May 20th, submit a 5-page pre-report with each page expanded from each of the 5 sections.
4. Jun. 17, submit the term report. The final format is the same of a typical artible paper.

Reference books

1. Karl Brown and Roger V. Servranckx, First- and Second-order Charged Particle Optics, SLAC-PUB-3381.
2. T. Shiozawa, Classic Relativistic Electrodynamics – Theory of Light Emission and Application to Free-electron Lasers, Springer-Verlag Berlin Heidelberg, 2004.
2. Levi Schachter, Beam-Wave Interaction in Periodic and Quasi-Periodic Structures, Springer-Verlag Berlin Heidelberg, 2011.

Grading Policy

Homework (weekly presentation slides) 40%
Weekly presentation performance 30%
Final Report 30%