

國立台灣大學電機工程學系/光電工程學研究所
(九十八學年度第二學期)

課程名稱: 非線性光學 (Nonlinear Optics)

選修或必修: 選修

學分: 3

修習年級: 研究生及大學部三四年級

教師姓名: 孫啟光(電機二館 319 室)

每週時數: 演講及討論三小時

內容綱要:

Principles of nonlinear optics with emphasis on the fundamental aspects of nonlinear optical theory and techniques. Course will cover: Maxwell's equations and the description of nonlinear processes. Nonlinear polarization, coupled wave equations, phase matching, and propagation. EO effect and nonlinear frequency generation. Third order optical nonlinearities. The quantum mechanical description of nonlinear phenomena. The two level atom, density matrix theory, perturbation theory, and double-Feynman diagram. Applications of nonlinear optical techniques for experimental measurement including Raman spectroscopy, photon echoes, and time-resolved spectroscopy.

評分方法: 作業 40%, 期中考 30%, 期末考 30%

參考書目:

1. Shen, The Principles of Nonlinear Optics
2. Boyd, Nonlinear Optics
3. Yariv, Optical Waves in Crystals
4. Haus, Waves and Fields in Optoelectronics

非線性光學

課程簡介

Part 1:

- 2/23 Introduction
- 3/4 Anharmonic oscillator
Nonlinear χ
- 3/11 Tensor analysis
Rotation and transformations
kDB formalism
- 3/18 Indicatrix, r_{ijk} tensor
EO modulator
- 3/25 Wave equation and envelope approximation
SHG and phase matching
- 4/1 Bandwidth and pulse propagation effects
Properties of $\chi^{(2)}$ and d_{eff} tensor
- 4/8 SHG with depletion
Sum and difference frequency processes
Parametric amplifier and oscillator
- 4/15 Third-order nonlinearity
FWM and solitons
- 4/22 Midterm
- 4/29 Instantaneous polarization
Harmonic generation with a tightly focused beam

Part 2:

- 5/6 Quantum Physics and perturbation theory
- 5/13 Atom-field interaction and two level atom
Fermi-Golden rule and Rabi frequency
- 5/20 CLEO Conference
- 5/27 Density matrix and linear polarization
Saturation in two-level atom
- 6/3 Integral equation and steady state
Raman scattering
- 6/10 Diagrammatic Representation
Feynman diagram
- 6/17 FWM and time-resolved spectroscopy