PAP 732 - Nonlinear Optics

Aims and Objectives

a. To build a thorough understanding of principles involved in nonlinear optical phenomena
b. To prepare students for research in optics-related topics

Syllabus

Nonlinear Optical Susceptibilities: Linear & nonlinear optical susceptibilities (focusing on $\chi^{(2)}$ and $\chi^{(3)}$); Wave propagation and coupling equations in linear and nonlinear media.

Second-order nonlinear optical effects: Second harmonic generation and phase matching technology; Sum- and difference-frequency generation; Parametric amplification and oscillation; Quasi-phase matching technique and Introduction to Photonic crystals.

Third-order nonlinear optical effects: Four wave interaction and coupling equation; Four-wave-mixing and phase conjugation; Intense beam induced refractive index change (Optical Kerr effect, self-focusing/defocusing, self-phase modulation); Nonlinear Optical Absorption (Two-photon absorption, saturable absorption and reverse saturable absorption); Electro-optic, acousto-optics and photorefractive effects.

Ultrasfast laser and ultrafast nonlinear optics: Pulsed optics (short pulse propagation in linear and nonlinear media, chirped pulse, group-velocity-dispersion, optical elements); femtosecond laser pulse generation and mode-locking method; pulse amplification, compression, and measurement; experimental techniques (pump-probe, ultrafast optical Kerr gate, fluorescence up-conversion and streak camera).

Assessment

Tests: 25%
Final Examinations: 60%
Others: Tutorials 15%

Prerequisites

PAP 362 Photonics and PAP 462 Quantum Electronics, or Division approval

Recommended Textbook
