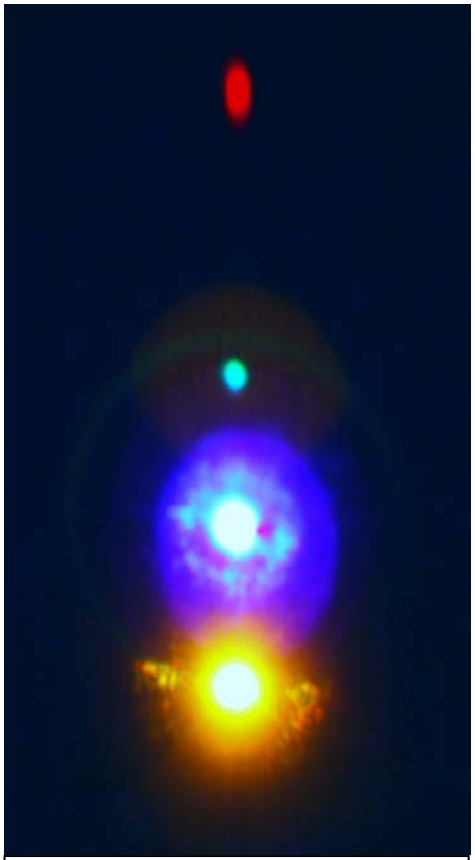
New course offered in Fall 13: Ultrafast Spectroscopy

Phys 667-010 & Chem 667-010, TuTh 3:30PM - 4:45PM Colburn Lab 102

Ultrafast Spectroscopy

This graduate course will focus on non-linear and ultrafast optics with application to ultrafast spectroscopy. After reviewing laser basics and Maxwell's equation we will discuss the generation and characterization of ultrashort laser pulses and its application in different fields of modern spectroscopy.



Pulse sequence after NOPA process: idler (red), pump (blue) and signal pulse (yellow).

Tentative Syllabus:

Laser Basics

Introduction to nonlinear Optics; Review of Maxwell Equation; 2-Level Atoms: Einstein Relation & Optical Bloch Equations; Dispersion, Absorption, Gain; Single Mode Laser and Q-Switching

Pulse Generation

Active & Passive Mode-Locking; Mode-Locking with Saturable Absorbers; Kerr-Lens Mode-Locking; Nonlinear Pulse Propagation

Pulse Compression, Characterization and Conversion

Pulse Compression & Shaping; Autocorrelation; FROG and SPIDER; Self-Phase Modulation (SPM) and Solitons; White Light Generation; Optical Parametric Amplification (OPA& NOPA); THz Generation, High-Harmonic Generation, Attosecond Pulses and X-ray generation

Spectroscopic Methods:

Pump-Probe Methods, Four-Wave Mixing and other third-order techniques, Time- resolved Electron Spectroscopy, Ultrafast Microscopy, Time-Resolved Electron Diffraction and Seeded Free-Electron Lasers

Textbook: Ultrashort Laser Pulse Phenomena, J.-C. Diehls, W. Rudolf, Elsevir 2006