Introduction: Maxwell equations and light-matter interactions

Simulation of ultra-short duration, high-intensity optical pulses

Anatomy of an optical-pulse simulator

Third-order nonlinear interactions
- Kerr effect, Raman effect and molecular reorientation
- Nonlinear self-focusing and beam collapse
- Self-focusing collapse arrest mechanisms
- Supercontinuum generation in bulk media and in fibers

Second-order NLO in solid-state media
- Full-field treatment vs envelope-based models
- Second-harmonic generation
- Supercontinuum and higher-harmonic generation

Strong-field interactions with atoms and molecules
- Quantum systems exposed to EM fields
- Strong-field approximation
- High-harmonic generation

Final project presentations