

PHYS570Y Atomic, Molecular, and Optical Physics I

Instructor: F. Robicheaux

Spring 2022

Time: 10:30-11:20 MWF

This course will present basic concepts of atomic, molecular, and optical (AMO) physics, as well as apply quantum mechanics and electromagnetism to solve AMO problems. Students will be introduced to atomic structures, interactions of atoms with radiation, and collision phenomena. This course provides students an overview of AMO physics at the single atom/molecule level, as well as a toolkit for understanding recent advances in quantum sciences and technologies.

Topics will include: the wavefunction of the electron(s) in hydrogen and helium atoms, transitions and selection rules, fine structure and Lamb shift, hyperfine structure, Zeeman effect, semi-classical treatment of atom-radiation interaction (Einstein A and B coefficients and Rabi oscillations), multi-photon processes in strong driving fields, and scattering theory applied to atomic and molecular processes.

This course is designed for students at the junior or senior undergraduate or entering graduate student level.

Required textbook is Christopher J. Foot “Atomic Physics” (available online free). We will cover Chaps. 1-7 and supplement with notes.

Required prerequisites are an undergraduate quantum class at the Griffiths level (through Griffiths Chap 5): PHYS360, PHYS460, PHYS550, PHYS660 or equivalent.