Physics 8420: Atomic Physics

Instructor: Olivier Pfister (135 Physics, 4-7956, opfister@virginia.edu, OH TBA)

Prerequisite: Phys 7620 (Quantum Mechanics II) or instructor permission.

Grading:	Homework (unpledged, $\sim$ one problem/week)	3/8
	Pledged homework	1/4
	Final exam	3/8

SYLLABUS

(May vary depending on class interest, but these are the broad strokes)

I Generalities of quantum mechanics

A. Fundamentals

Quantum mechanics postulates and important theorems

B. Advanced treatment of symmetry in quantum mechanics

Point symmetry groups

Group representation theory

II Atomic structure

A. Basics and reminders

Central potentials, angular momentum, the Hydrogen atom, other single-electron atoms.

B. Advanced treatments

Multielectron atoms

Fine and hyperfine structure

Group-theoretical methods [O(3), SU(2), Racah algebra]

Spherical irreducible tensors

Coupling and recoupling

Wigner-Eckart theorem

III Light-atom interaction

A. Spontaneous emission (there is no isolated atom)

Stimulated emission by the vacuum field

Introduction to cavity quantum electrodynamics

B. Laser spectroscopy

2-level system

Dressed states

3-level systems: coherent population trapping and electromagnetically induced transparency