Physics 607 **Atomic Physics** **Fall 2001**

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Text:	"Lecture Notes on Atomic Physics"
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Exams:	Sept. 21, Oct. 12, Nov. 16	60%
Final:	Dec. 15	20%
Home work:	Due each Monday	20%

Outline for August - September

Month	Day	Chap	Topic
Aug	29	I.1	Orbital Angular Momentum
	31	I.2	Spin Angular Momentum
Sep	3	I.3	Clebsch-Gordan and $3j$ Symbols
	5	I.4	Graphical Rules
	7	I.5	Spinor & Vector Harmonics
	10	II.1-2	Radial Schrödinger Equation
	12	II.3	Numerical Solution to Radial Equation
	14	II.4	Thomas-Fermi & Hartree Potentials
	17	II.5-6	Radial Dirac Equation
	19	II.7	Numerical Solution to Dirac Equation
	21	III.1	Self-Consistent Fields – Helium Atom
	24	III.2	Hartree-Fock (HF) for Closed-Shell Atoms
	26	III.4	HF for Atoms with One Valence Electron
	28	III.5	Dirac-Fock Equations

Outline for October - December

Month	Day	Chap	Topic
Oct	1	IV.1	Second-Quantization
	3	IV.3	Two-Electron States: Singlets – Triplets
	5	IV.4	Atoms with One or Two Valence Electrons
	8	IV.5	Particle-Hole Excited States
	10	IV.6	Relativity, Breit & Fine Structure
	12	V.1	Hyperfine Structure (HFS)
	15	V.2	HFS for Atoms with 1 Valence Electron
	17	V.3	HFS for Many-Electron Atoms
	19	V.4	Specific-Mass Shift (SMS)
			Fall Break
	29	VI.1	Classical Radiation Field
	31	VI.2	Quantum Mechanical Transitions
Nov	2	VI.3	Electric-Dipole Transitions
	5	VI.4	Magnetic-Dipole – Electric Quadrupole
	7	VI.5	Retarded Multipole Transitions
	9	VII.1	Many-Body Perturbation Theory (MBPT)
	12	VII.2	B-spline Basis Sets
	14	VII.3	2nd-Order MBPT
	16	VII.4	3rd-Order MBPT
	19	VIII.1-2	Transitions: RPA & Shielding
	21	VIII.3-4	2nd-Order & Core Polarization
	23		**Thanksgiving Break**
	26	VII.5-6	MBPT Calculations of HFS & SMS
	28	VIII.1	Susceptibilities and Shielding Factors
	30	VIII.2	RPA Polarizabilities for Closed-Shell Atoms
Dec	3	VIII.3	MBPT Calculations of Polarizabilities
	5	VIII.4	Lennard-Jones and van der Waals Coefficients
	7	IX.1	Configuration Interaction
	10		**Last Day of Class**
	15		**Final Exam**