PHYS 850: Theory of Atomic Structure

MWF 10:30, CW 143

Fall 2000

Instructor:

Dr. Brett Esry
CW 329
532-1620
esry@phys.ksu.edu
http://www.phys.ksu.edu/~esry

Office hours:

By appointment

Textbook:

Physics of Atoms and Molecules, B.H. Bransden and C.J. Joachain

Supplement:

Theoretical Atomic Physics, H. Friedrich
Angular Momentum, R.N. Zare
Quantum Chemistry, J.P. Lowe

Grading:

Exam 1	15%
Exam 2	15%
Final	20%
Homework	50%

Homework:

You will learn the most in this course from the homework. Assignments will be given roughly once per week. I encourage you to discuss the problems with your classmates, but you should write up the assignment on your own. Some assignments will require computer work.

Students with disabilities:

If you have any condition such as a physical or learning disability that will make it difficult to carry out the work as I have outlined it or that will require academic accomodations, please notify me and contact the Disabled Students Office (Holton 202) in the first two weeks of the course.

Plagiarism:

Plagiarism and cheating are serious offenses and may be punished by failure on the exam, paper, or project; failure in the course; and/or expulsion from the University. For more information refer to the "Academic Dishonesty" policy in the *K-State Undergraduate Catalog* and the *Undergraduate Honor System Policy* on the Provost's web page at `http://www.ksu.edu/honor/`.

Topics:

1. **Introduction:** Chapters 1 and 2
   Mainly variational principle.

2. **One-electron atoms:** Chapter 3 (Quickly)
   Hydrogen; positronium.

3. **Interaction of one-electron atoms with EM fields:** Chapter 4
   Transition rates; dipole approximation; selection rules; line shapes.

4. **One-electron atoms in external fields:** Chapter 5
   Fine structure; hyperfine structure; Zeeman effect; Stark effect; Lamb shift.

5. **Two-electron atoms:** Chapter 6
   Center of mass separation; Pauli exclusion principle; approximation methods; hyperspherical coordinates; doubly-excited states.

6. **Many-electron atoms:** Chapter 7–8
   Central field approximation; Hartree-Fock approximation; LS and jj coupling; selection rules; shell structure.

7. **Molecular structure:** Chapter 9
   Center of mass separation; Born-Oppenheimer approximation; diatomic molecules; polyatomic molecules; symmetries.

8. **Molecular spectra:** Rovibrational spectra; selection rules.