PHYS 601 - Atomic Physics
3 Credit Hours

Survey of research problems and methods. Topics of current interest.
Comment(s): Intended for all graduate students.
Registration Restriction(s): Minimum student level – graduate.

This course is part 1 of the Phys601/Phys602 series. The first class meeting will be at the UTSI campus lower E August 24, 1pm to 3:30pm CDT (that would be 2pm to 4:30 pm at the UTK campus, using zoom). The class meeting times and days will be determined based on student's research and work schedules. For the first meeting, other than the overview of the course: Aims, goals, objectives, the major topic will be on line shapes and widths (section M of the syllabus) with excerpts taken from the 2003 web-edition of the book "The Fundamentals of Stellar Astrophysics."

General Information

Christian Parigger

Backbone for Phys601(Fall 2017) and Phys602 (Spring 2018): Bransden & Joachain, plus ample references to ongoing areas of interest including discussions of specific atomic and molecular Physics aspects, e.g., from current conferences or current journals.

However, there is some back ground reading, and lecture topics that will also cover aspects of A) to M)

---Table of contents of Bransden and Joachain, with references to literature and Condon &Shortley to name but one other classic book

1. A) Blackbody radiation, photoelectric effect, Compton effect;

2. B) Rutherford scattering, Bohr's model and failure, electron spin and relativistic treatment;

3. C) De Broglie's hypothesis, electron diffraction, double-slit experiment, wave-particle duality;

4. D) Classical Physics harmonic oscillator, resonances, Fabry-Perot;

5. E) Motion of electrons in homogeneous magnetic field, e/m measurements by Bucherer and Kaufmann;

6. F) Postulates of Quantum Mechanics, Schroedinger equation, Heisenberg uncertainty principle;

7. G) Quantum Physics harmonic oscillator, angular momentum, potential wells, approximation methods, Fermi's Golden Rule;

8. H) Hydrogen atom ad hydrogen-like atoms, Pauli exclusion principle, LS coupling, JJ coupling;

9. I) Molecular structure, diatomic molecules, spectra;

10. J) Drude theory of solids, band theory of solids;

11. K) Statistical ensembles, Maxwell-Boltzmann, Fermi-Dirac, Bose-Einstein distribution;

12. L) Laser principles, Einstein A and B coefficients, failure of classical physics.

13. M) Line shapes and widths, two-state atom;

A set of three homework assignments will be given, you have about 4 weeks each, and then there is the final exam assignment.