

Quantum Electronics II (Physics 566)

Atomic and Molecular Dynamics

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Tu & Th 10-11:20

Topics

1. Hydrogen atom (gross structure)
 2. Hydrogen atom (fine and hyperfine structure)
 3. Helium
 4. Quantum defect theory
 5. Stark effect – DC
 6. Molecular structure basics – H_2^+ and the Born Oppenheimer approximation (T)
 7. Wave packets – coherent superposition states with dispersion (T)
 8. Wave packet propagation (T)
 9. Atom field interactions – Dipole approximation
 10. Adiabatic dynamics (T)
 11. Two level atom with strong fields – AC Stark effect (T)
 12. Dressed states – Bloch sphere (T)
 13. Adiabatic rapid passage and STIRAP (T)
 14. Adiabatic elimination and multi-photon transitions (T)
 15. Wave packet interferometry (T)
 16. Clocking chemical reactions (T)
 17. Coherent nonlinear spectroscopy (T)
 18. ...
- (T) denotes material covered in David Tannor's textbook: "Introduction to Quantum Mechanics: A Time-Dependent Perspective"

Grading

Problem Sets: 40%
Midterm Exam: 20%
Project: 10%
Final Exam: 30%

The problem sets will consist of both analytical problems as well as computer based assignments involving simulations and solving differential equations numerically.

The project will consist of selecting a paper from a collection of suggested papers and presenting it to the class as a journal club presentation.