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 – H₂⁺ 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.