

Quantum theory of light-matter interaction: Fundamentals

Themes of the complex exam

1. Classical electromagnetic field, slowly varying envelope approximation
2. Linear dipole oscillator, Lorentz model
3. Nonlinear dipole oscillator, classical nonlinear optics
4. Three- and four-wave mixing
5. Fundamentals of quantum systems interacting with a classical electromagnetic field
6. Time-dependent perturbation theory
7. Single atom in an electromagnetic field
8. Density operator, two-level atoms, Rabi oscillations, pumping and damping (
9. Interaction of continuous wave fields with two-level media, fundamentals of laser theory
10. Special topics in laser theory and laser spectroscopy
11. Mechanical effects of light on atoms: laser cooling and trapping
12. Coherent transient phenomena, self-induced transparency and superradiance

Literature:

P. Meystre, M. Sargent: Elements of Quantum Optics, Springer, 2007

A. Aspect, C. Fabre, G. Grynberg: Introduction to Quantum Optics, Cambridge, 2010

M. Benedict, A. Czirják, P. Földi: Quantum theory of light-matter interaction: Fundamentals

Lecture Notes:

http://www.staff.u-szeged.hu/~czirjak/Quantum_theory_of_light-matter_interaction/