Announcement

Introduction to Quantum Electronics

Dr. Siyushev

Description

This course aims to introduce and provide required knowledge on quantum electronics for those who are planning to work in modern optics and utilize laser field for research and development. This course discusses interaction of coherent fields with atomic systems, specificity of the gain medium, transition rates, etc. Special place in this course is dedicated to the detailed theoretical description of laser cavities. The course is finishing by consideration of the most common laser systems and their specific characteristics.

Content

- Spontaneous and stimulated transitions, Einstein coefficients, coherence of stimulated emission
- Light-matter interaction, transition probability
- Spectral line shape, inhomogeneous and homogeneous broadening
- Absorption and amplification, gain medium, saturation
- Laser oscillations, feedback, lasing threshold, resonant conditions
- Gaussian beams, beam's caustics, evolution of Gaussian beams
- Optical cavities, stability criterion, cavity losses
- Lasing on several longitudinal modes, mode locking, pulsed regime, Q-switching
- The most common lasers, main excitation methods, gas lasers, solid state lasers, semiconductor lasers, dye lasers, free-electron lasers

Prerequisites

Classical electrodynamics

Literature

- Orazio Svelto, Principles of Lasers (Springer, 2010)
- Amnon Yariv, Quantum Electronics (John Wiley and Sons 1988)
- Amnon Yariv, Introduction to Optical Electronics (Holt, R.& W 1971)

More advanced literature will be provided through the course.

Additional information

Lecture (2 hours per week)

Oral examination

3 ECTS credits

Lecturer

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