Level: bachelor

Course title: Atomic physics

Status: obligatory

ECTS: 7

Requirements: Electromagnetism, Optics, Basic electronics, Quantum mechanics, Introduction to Atomic physics

Learning objectives

To introduce students to mastering the basics of atomic physics.

Learning outcomes

After completion of the course, students should possess:
- General skills: knowledge which is applicable in chemistry, molecular physics, gas discharges and in astrophysics, nuclear physics and condensed matter physics.
- Specific skills: developing the ability to understand the specific atomic structure of matter. Students are trained to follow a higher course of atomic physics.

Syllabus

Theoretical instruction

Schrödinger equation. Linear harmonic oscillator in quantum mechanics. Hydrogen-like atoms in quantum mechanics. Interpretation of the Schrödinger equation solution. Valence electron model of atoms. Spectral series of alkali metals. Electron orbit magnetic moment. Electron spin. Total electron angular momentum. Theory of atoms with more than one electron. Vector atom model. Magnetic momentum of the atom. Multiplet structure of the LS terms. Periodic table of elements. Superfine structure of spectral lines.
Atom in external magnetic and electric field. Excitation and deexcitation of atomic energy levels. Lifetime of excited states. Emission and absorption of the radiation. Intensity and spectral line broadening. Stimulated emission of radiation. Quantum amplifier and quantum generator. Lasers. Some effects of nonlinear optics. Molecule formation. Molecular vibration energy. Molecular rotation energy. Molecular vibration rotation spectrum. Electronic spectra of diatomic molecules. Electronic spectra of multiatomic molecules. Photo-fluorescence and phosphorescence. Combination scattering of light, Raman effect. Spectroscopy.

Practical instruction

Emission spectra of atoms. Quantitative spectral analysis. Fabry-Perot interferometer, Zeeman effect. Electronic spectrum of cyan. Absorption spectrum of multiatomic molecules. Fluorescent spectrum of multiatomic molecules. He-Ne laser.

Weekly teaching load				Other:
Lectures: 3	Exercises: 2	Other forms of teaching: 1	Student research:	