



PHYSICS

FYP310 Atomic and Molecular Physics, 7.5 credits

Atom och molekylfysik, 7,5 högskolepoäng

First Cycle

Confirmation

This course syllabus was confirmed by Department of Physics on 2017-08-08 to be valid from 2017-08-08, autumn semester of 2017.

Field of education: Science 100%

Department: Physics

Position in the educational system

The course is included in the Physics program and is also given as a freestanding course.

Advanced course in the main subject physics.

The course can be part of the following programme: 1) Bachelor of Science in Physics (N1FYS)

Main field of studies

Physics

Specialization

G2F, First Cycle, has at least 60 credits in first-cycle course/s as entry requirements

Entry requirements

Completed courses from school year 1 and 2 in the Physics program, or that the equivalent knowledge has been acquired in some other way.

Learning outcomes

On completion of the course Atomic and Molecular Physics the student is expected to:

Knowledge and understanding

- have an understanding of basic properties of atoms and molecules;
- be familiar with different models for describing atoms and molecules;

Competence and skills

- be able to describe concepts, models and working methods in theoretical and experimental atomic and molecular physics;
- be able to make experimental and theoretical atomic and molecular studies to show that he/she has understood electron structure and dynamics of these quantum systems;

Judgement and approach

- master both experimental and theoretical working methods within atomic and molecular physics to be able to make correct evaluations and assessments;
- be able to use relevant measurement equipment as well as be able to evaluate experimental results;

Course content

The course consists of the following parts:

1. Atomic and Molecular Physics- 3.0 credits

In this part the following is treated:

Repetition of the foundations of quantum mechanics; states and state functions, in particular stationary states; expectation values.

One-electron atoms: Energy levels and wave functions; angular momenta; spin-orbit coupling; relativistic and QED related effects; transitions; quantum numbers and selection rules; spectra.

Helium: Approximation methods; the coulomb and exchange integral; the ground state; excited states; wave functions and their symmetry; spectra.

Many-electron atoms: theoretical approximation methods; mainly LS-coupling; fine structure; spectra.

Molecular quantum mechanics: the H_2^+ molecule, the H_2 molecule, binding, the LCAO-MO approximation; semiempirical calculation methods; electronic states and electron correlation; potential curves; interaction with electromagnetic radiation; transitions between different states; the Franck-Condon principle; symmetry-adapted molecular orbitals; electronic spectra; analysis of molecular movement; rotations and vibrations.

2. Handing in assignments- 2.0 credits

Handing in assignments related to part 1.

3. Experimental physics- 2.0 credits

Project exercise in optical spectroscopy on atoms and molecules.

4. Laboratory session- 0.5 credits

Laboratory session in vibration and rotational spectroscopy on a diatomic molecule.

Form of teaching

Used forms of teaching:

Compulsory parts with requirements of attendance: Experimental physics (part 3) as well as laboratory sessions (part 4).

Language of instruction: Swedish

Assessment

Examination formats:

Part 1: written exam, 3.0 credits

Part 2: handing in assignments, 2.0 credits

Part 3: complete assessment bases with pre-study report, laboratory notebook and final report, 2.0 credits

Part 4: Project report, 0.5 credits

A student has the right to request a change of examiner if failed twice on the same exam, if this is practically possible. The application shall be sent to the board of the department and has to be in writing.

Grades

The grading scale comprises: Pass with Distinction (VG), Pass (G) and Fail (U).

For grade of Pass on the whole course, Pass on all parts is required.

For grade of Pass with distinction on the whole course, Pass with distinction on at least two parts as well as Pass on other parts is required.

For each part applies:

Part 1: Written exam with grade Fail, Pass or Pass with distinction.

Part 2: Handing in assignments with grade Fail, Pass or Pass with distinction

Part 3: For grade Pass, passed pre-study report, laboratory notebook and final report is required. For grade Pass with distinction, a well completed additional assignment is also required.

Part 4: For grade Pass, approved project report is required.

Course evaluation

At the end of the course an anonymous course evaluation is provided. The result is published on the course homepage in University of Gothenburg's learning management system (GUL).

Additional information

There is an older version of the course syllabus but this has not been put in to the "Gubas Kursplan" system.