Faculty of Science

# ASTA34, Astronomy: Radiation Processes and Stellar Atmospheres, 7.5 credits

*Astronomi: Strålningsprocesser och stjärnatmosfärer, 7,5 högskolepoäng*

**First Cycle / Grundnivå**

## Details of approval

The syllabus was approved by Study programmes board, Faculty of Science on 2011-01-19 and was last revised on 2011-01-19. The revised syllabus applies from 2011-01-19, spring semester 2011.

## General Information

The course is an elective course for first-cycle studies for a Bachelor of Science in physics.

*Language of instruction:* Swedish and English
If needed the course is given in English.

| *Main field of studies* | *Depth of study relative to the degree requirements* |
|---|---|
| Physics | G2F, First cycle, has at least 60 credits in first-cycle course/s as entry requirements |

## Learning outcomes

The aim of the course is that students should have acquired the following knowledge and skills upon completion of the course:

*Knowledge and understanding*

On completion of the course, the student should:

*in detail be able to*

- describe characteristics of the atmospheres of the sun and other stars
- describe atomic spectra and their structure for laboratory sources and in stellar spectra
- describe the effects of temperature, pressure and chemical abundances

*have general knowledge about*

- individual and collective properties of atoms in different plasmas
- phenomena in the atmospheres of the sun and other stars
- methods for calculation of lines in stellar spectra
- the rotation and oscillations of stars, and their coronae and winds
- instruments for studies of stellar atmospheres

*Skills and abilities*

On completion of the course, the student should:

have acquired skills in

- experimental laboratory work with atomic light sources
- calculation of the radiative transfer through stellar atmospheres and other hot gases

## Course content

The course describes the outer structures of stars; atomic radiation processes in plasmas in the laboratory and in space, studied by spectroscopy throughout the electromagnetic spectrum from X-ray to radio, and that are used to explore atmospheres of different stars.

Basic properties of stars and their atmospheres; the solar atmosphere and its phenomena as a typical example for other stars; the spectra of stars and the origin of spectral lines; convection and gas motions; mass loss: stellar coronae and stellar winds; pulsating stars; shock waves; dust shells

Extreme objects: early-type supergiant and cool brown dwarfs; white dwarfs and neutron stars.

Radiation and energy transformation in plasmas: distribution rules and radiative transfer.

The structure of atoms and molecules: allowed and forbidden spectral lines; thermodynamic equilibrium and deviations from it.

Different experimental methods and instruments on Earth and in space: spectrometers, polarimeters, photometers, interferometers.

The interplay between different processes is illustrated in more detail with some case studies e. g. the origin of emission lines from nebulae and of absorption lines in the solar atmosphere.

## Course design

The teaching consists of lectures, laboratory sessions and exercises Participation in laboratory sessions and exercises and thereby integrated other teaching is compulsory.

## Assessment

The examination consists of laboratory reports and a written exam at the end of the course. Students who do not pass the regular exam are offered a new possibility shortly after the regular exam.

*Subcourses that are part of this course can be found in an appendix at the end of this document.*

## Grades

Marking scale: Fail, Pass, Pass with distinction.
To pass the entire course: approved examination, approved laboratory reports and other written assignments and participation in all compulsory parts is required. The final grade is determined by combining the results of the different parts of the examination.

## Entry requirements

For admission to the course, knowledge equivalent to FYSC11 Atomic and Molecular Physics, 7.5 credits, FYSA31 Physics 3, 30 credits or the equivalent is required.

If the course is given in English, prior knowledge equivalent to upper secondary course English B is also required.

## Further information

The course may not be counted towards a degree together with ASTA31 Star atmospheres 7.5 credits, AST009 Star atmospheres 7.5 credits, AST215 the physics of the Stars 15 credits, AST315 the physics of the Stars 15 credits, ASTA32 Atomic astrophysics 7.5 credits or AST220 Atomic astrophysics, 7.5 credits.

## Subcourses in ASTA34, Astronomy: Radiation Processes and Stellar Atmospheres

Applies from V10

1101 Radiation Processes and Stellar Atmospheres, 7,5 hp
Grading scale: Fail, Pass, Pass with distinction