Faculty of Science

ASTM18, Astronomy: Observational Techniques and Instrumentation, 7.5 credits

Astronomi: Observationsteknik och instrumentering, 7,5 högskolepoäng

Second Cycle / Avancerad nivå

Details of approval

The syllabus was approved by Study programmes board, Faculty of Science on 2007-06-14 to be valid from 2007-07-01, autumn semester 2007.

General Information

The course is an optional course for second-cycle studies for a Degree of Master of Science (120 credits) in astrophysics.

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

Main field of studies	*Depth of study relative to the degree requirements*
Physics	A1N, Second cycle, has only first-cycle course/s as entry requirements
Astrophysics	A1N, Second cycle, has only first-cycle course/s as entry requirements

Learning outcomes

On completion of the course, the student shall have received general knowledge of different instruments and observational techniques of significance within astrophysics and a more in-depth knowledge of telescopes, auxiliary instruments and detectors for astronomical observations within the optical and infrared wavelength region. The student shall
at a general level be able to

- describe the principles of detection of astronomical signals in different parts of the electromagnetic spectrum

- describe the effect of the atmosphere on electromagnetic radiation from space
- describe advantages and disadvantages with different telescope constructions regarding their optical and mechanical properties
- understand the principles of aperture synthesis
- describe important observations in space and what these can or are expected to be able to achieve

in more detail be able to

- explain the function and properties of modern CCD detectors
- explain the standard methods for processing electronic images
- analyse advantages and disadvantages with various types of spectrometers
- describe principles, problems and solutions for adaptive optics

have obtained training in

- how to estimate expected resolution, signal-to-noise ratios and precision in a given observational situation
- how to plan an observing run at a modern observatory
- how to use standard programs for reduction of photometric and spectrometric data.

Course content

The course contains the following aspects:
Electromagnetic radiation and non-photonic astronomy. The effect of the atmosphere on observations. Detectors for optical and infrared radiation. Detectors for radio waves. The noise characteristics of detectors. Signal-to-noise ratio, quantum efficiency and detective quantum efficiency. Light collecting and imaging instruments. Adaptive optics and extremely large telescopes. Space observatories. Spatial resolution and modulation transfer function. Interferometry, visibility, (u,v)-plane and interferometric imaging. Photometry, photometric systems and photometric reduction methods. Spectroscopy, grating, echelle and Fourier transform spectrometers. Astrometry through the atmosphere and from space. Polarimetry and determination of the Stokes vector.

Course design

The teaching consists of lectures, laboratory sessions, group work and project work. Participation in laboratory sessions, group work and project work and other connected teaching is compulsory.

Assessment

The examination consists of laboratory reports and project work as well as a written and an oral test 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, a passed project report 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 English B and knowledge equivalent to FYSA31 Physics 3, modern physics, 30 credits is required.

Further information

The course may not be credited towards a degree together with AST218, Astronomical observation technique 5p.

Subcourses in ASTM18, Astronomy: Observational Techniques and Instrumentation

Applies from V12

0702 Observational Techniques and Instrumentation - Theory, 6,0 hp
Grading scale: Fail, Pass, Pass with distinction
0703 Exercises, 1,5 hp
Grading scale: Fail, Pass, Pass with distinction

Applies from H07

0701 Observational Techniques and Instrumentation, 7,5 hp
Grading scale: Fail, Pass, Pass with distinction