Faculty of Science

ASTC13, Astronomy: Galaxies and Cosmology, 7.5 credits

Astronomi: Galaxer och kosmologi, 7,5 högskolepoäng

First Cycle / Grundnivå

Details of approval

The syllabus was approved by The Education Board of Faculty of Science on 2024-12-03. The syllabus comes into effect 2024-12-03 and is valid from the autumn semester 2025.

General information

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

Language of instruction: English

Main field of study	*Specialisation*
Physics	G2F, First cycle, has at least 60 credits in first-cycle course/s as entry requirements

Learning outcomes

On completion of the course, students are to have acquired a detailed overview of our galaxy, the Milky Way, galaxies in general, and the origin and evolution of the Universe

Knowledge and understanding

On completion of the course, the student is expected to be able to:

- describe, also quantitatively, the evolution of a stellar population (including IMF, HR-diagram and integrated spectra)
- explain the importance of the cosmological distance scale and be able to use different indicators of distance in given problems
- describe the evolution of the Universe under different conditions (e g presence of dark energy)
- explain observational limitations on the exploration of the Universe

- describe the structure and chemical evolution of the Milky Way
- explain how star formation takes place and its influence on galaxies
- explain the structure of galaxies, including how the star formation history of galaxies can be explored
- describe how galaxies are formed and evolve with special focus on modern theories of galaxy formation
- describe how we explore the Universe on its largest scales and how these studies relate to theories of the evolution of the Universe

Competence and skills

On completion of the course, the student is expected to be able to:

- Plan, execute and interpret radio observations of gas and dust cluds in the Milky Way
- Interpret observations of stellar populations, galaxies, and the large scale Universe
- Construct a colour-magnitude diagram for a distance galaxy cluster and understand the connection between colur and magnitude for the galaxies within.

Judgement and approach

On completion of the course, the student is expected to be able to:

- Critically review astronomical observations, discuss statistical and systematic sources of uncertainties, and the possibilities of achieving the stated scientific goals from the observations

Course content

The course addresses properties of the Milky Way and other types of galaxies regarding structure, chemical evolution and the interplay between stars and the interstellar medium.

The course provides specialised knowledge of:

- Methods for distance and mass determination.
- Dark matter.
- Hubble's law and the expansion of the Universe.
- Observations and descriptions of models of active galactic nuclei, especially quasars.
- The mass density and geometry of the Universe.
- Theoretical models of the Universe, comparisons with observations.
- Nucleosynthesis in the early Universe Cosmological background radiation.
- Dark energy.

Course design

The teaching consists of lectures and practical exercises. The lectures include scientific problems, research methods and research results concerning galaxies and cosmology. The practical exercises can include observation and laboratory experiments, computer simulations and problem-solving as well as literature assignments. The compulsory practical exercises are intended to give familiarity with instruments and methods as well as individual work within the subject area.

Assessment

The examination consists of reports from laboratory exercises and a written examination at the end of the course.

Students who do not pass a regular assessment will be offered another opportunity for assessment soon thereafter.

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

Grades

Grading scale includes the grades: Fail, Pass, Pass with distinction
The grading scale for the reports from the laboratory sessions is Fail and Pass. The grading scale for the final written examination is Fail, Pass and Pass with Distinction. To pass the entire course it is necessary to pass the examination and passed written reports from all laboratory sessions.

The final grade is determined by the grade of the written examination. The pass mark is 50% and the mark for pass with distinction is 80%.

Entry requirements

Admission to the course requires 105 credits in physics and/or mathematics, including knowledge equivalent to ASTC12, Astronomy: Astrophysics of stars, 7.5 credits. , as well as proficiency in English equivalent to English 6/B from Swedish upper secondary school.

Further information

The course replaces ASTA33, Introduction to galaxies and cosmology, 7.5 credits and cannot be credited towards a degree together with this course, nor with AST214 Galaxies and cosmology, 5 credits or AST314 Galaxies and cosmology 5 credits.

The course is offered at the department of Physics, Lund University.