Faculty of Science

ASTM27, Astronomy: Extragalactic Astronomy, 7.5 credits

Astronomi: Extragalaktisk astronomi, 7,5 högskolepoäng

Second Cycle / Avancerad nivå

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 a compulsory second-cycle course for a Degree of Master of Science (120 credits) in Astrophysics. The course is an elective second-cycle course for a Degree of Bachelor of Science in Physics and a Degree of Master of Science (120 credits) in Physics.

Language of instruction: English

Main field of study	*Specialisation*
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

The aim of the course is for the student to have acquired knowledge of theoretical and observational aspects of fundamental cosmology, the dynamic and thermodynamic evolution of the universe, and the diversity, origin, evolution and structure of galaxies.

Knowledge and understanding

On completion of the course, the student shall be able to:

- give an account of the main elements of the evolution of the universe and describe them in writing using equations

- name and explain cosmologically relevant parameters
- give an account of nucleosynthesis shortly after the Big Bang
- explain how cosmic microwave background radiation originated
- give an account of the origin of cosmic structure and dark matter halos
- give an account of the current paradigm in galactic formation
- explain the interaction between stars and gas in a galaxy and how our understanding of this is supported by observations and computer simulations
- describe in general terms the observed properties of galaxies, e.g. morphologies, sizes, masses, internal structures and stellar populations.
- give an account of the properties of AGN (Active Galactic Nuclei) in the context of the so-called "unified AGN" model
- explain how star formation history and chemical evolution of galaxies can be obtained using photometry and spectroscopic data
- explain the mechanisms behind spiral structure in galactic discs
- describe and explain limitations and biases in extragalactic observations.

Competence and skills

On completion of the course, the student shall be able to:

- perform calculations describing the dynamic and thermodynamic evolution of the universe
- perform calculations of the age of the universe, distances to galaxies and the link between red shift and cosmological timescales and distances based on a given metric/cosmology
- perform calculations with the galaxy luminosity function.
- write a report on how the luminosity function, CMD (Colour Magnitude Diagram) or stellar population synthesis models can be used to obtain information on observed galaxies.
- present and discuss the content of research papers in the field of extragalactic astronomy.

Judgement and approach

On completion of the course, the student shall be able to:

- critically review and discuss the content of research articles and discuss them with peers.

Course content

The course provides specialised knowledge of

- Friedmann equations, their solutions and applications.
- Nucleosynthesis in the early universe.
- Determination of the Hubble constant and other constants and parameters that determine the physical universe.

- The thermal and dynamic evolution of the universe.
- The formation of galaxies and large-scale structure in the universe.
- The role of dark matter.
- The diversity of galaxies and their internal structure.
- Photometric and spectroscopic observations and how this can help us to obtain information about the star formation history and chemical evolution of galaxies.
- Historical background to the subject of extragalactic astronomy.

Course design

The teaching consists of lectures, written assignments and presentation/discussion of research articles. Written assignments and presentation/discussion of research articles are compulsory.

Assessment

Assessment is through an exam at the end of the course and through compulsory components.

For students who have not passed the regular exam, an additional examination is offered during the scheduled resit period.

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
A grade of Pass for the course requires a grade of Pass for the exam and participation in the compulsory components.

The grading scale for the written exam is Fail, Pass and Pass with Distinction.

The final grade is determined by the grade for the exam.

Entry requirements

Access to the course requires knowledge equivalent to ASTC13, Astronomy: Galaxies and Cosmology, 7.5 credits or FYSN28, Physics: General Theory of Relativity, 7.5 credits. General entry requirements and English 6/B.

Further information

The course replaces ASTM19, Extragalactic Astronomy and cannot be credited in the degree together with it.

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