SH2204 Astroparticle Physics 7.5 credits

Astropartikelfysik

This is a translation of the Swedish, legally binding, course syllabus.

If the course is discontinued, students may request to be examined during the following two academic years

Establishment

Course syllabus for SH2204 valid from Autumn 2013

Grading scale

A, B, C, D, E, FX, F

Education cycle

Second cycle

Main field of study

Physics

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

After completing this course, students should be able to:

- Classify the fundamental subatomic particles by their possible interactions.
- Explain how 'particle probes' can open a new window on the universe compared to observations using electromagnetic radiation.
- Explain how particles can be detected and their properties determined, and appreciate the
limitations of different detection techniques.
- Identify the astrophysical observations which motivate the key features of the current cosmological models.
- Calculate parameters for the expansion of the universe in radiation- and matter-dominated
epochs and compare this with observational data
- Describe results that give evidence for the existence of dark matter, and hypothesize over the
possible particle candidates for dark matter in the universe.
- Experimentally confirm the existence of dark matter through radio telescope observations
- Perform dimensional analysis to define relationships between physical variables in astrophysical
systems.
- Interpret data from figures published in the scientific literature and use this to perform calculations and develop conclusions.
- Reflect on the current 'open questions' in astroparticle physics and the experiments planned to
- address these issues.

Course contents

The course gives a solid foundation in Astroparticle Physics, with a particular focus on the experimental aspects.

- Overview of the concepts of particle physics
- Cosmology: Big Bang, cosmic microwave background, content and dynamics of the Universe
- Cosmic rays: galactic, production and acceleration, detection
- Neutrino astrophysics: stellar neutrinos, high energy neutrinos, atmospheric, detection
- Dark matter: dark matter candidates, experiments
- Nucleosynthesis in the Big Bang and in supernovae
- Detection techniques: Cosmic rays, high-energy photons, polarization, benefits of multimessenger approach
- Outlook and connection to other research fields

Specific prerequisites

Subatomic physics (SH2103), or equivalent.

Course literature

Particle astrophysics, D. Perkins (2nd edition, 2009). OUP.

Hand-outs.

Examination

- INL1 - Home Assignments, 5.0 credits, grading scale: A, B, C, D, E, FX, F
- LAB1 - Laboratory, 1.0 credits, grading scale: P, F
- PRO1 - Seminar, 1.5 credits, grading scale: P, F

Based on recommendation from KTH’s coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

Home assignments (5 hp)

Seminar (1.5 hp)

Laboratory (1 hp)

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.