GHENT UNIVERSITY

Course Specifications

Valid in the academic year 2025-2026

Cosmology and Galaxy Formation (C002512)

Course size *(nominal values; actual values may depend on programme)*

Credits 6.0 **Study time 180 h**

Course offerings and teaching methods in academic year 2025-2026

A (semester 1)	Dutch	Gent	seminar
			lecture

Lecturers in academic year 2025-2026

De Rijcke, Sven	WE05	lecturer-in-charge

Offered in the following programmes in 2025-2026	crdts	offering
Master of Science in Teaching in Science and Technology(main subject Mathematics)	6	A
Master of Science in Teaching in Science and Technology(main subject Physics and Astronomy)	6	A
Master of Science in Mathematics	6	A
Master of Science in Physics and Astronomy	6	A
Master of Science in Physics and Astronomy	6	A

Teaching languages

Dutch

Keywords

Galaxies, cosmologie, Friedman-Lemaitre models, dark matter, dark energy, cosmic structure, background radiation, concordance model, quintessence, inflation theory

Position of the course

The aim of this course is to give a thorough treatment of the large scale dynamics of the universe (i.e. its accellarating expansion), of the formation of cosmic structure (clusters, voids, galaxies), and of the physics of the cosmic microwave background fluctuations. This course builds on the compulsory courses "Relativity theory and introduction to elementary paricle physics" and "Introduction to astronomy". The students should have followed successfully these courses or have acquired their competences in another way. This course is complementary to the optional course "Nuclear astrophysics" in which Big Bang nucleosynthesis and the thermal evolution of the universe are treated.

Contents

The course starts with an overview of the phenomenology of galaxies and of cosmological observations (large-scale distribution of galaxies, the Hubble expansion, the accelerating universe, ...). Friedman-Lemaitre models for the dynamics of the universe. Evolution of cosmic structure, from the primordial density fluctuations left over after inflation to the formation of virialised objects, such as galaxies. Effects due to cold and/or hot dark matter. Numerical simulations of structure formation. Recent observations of the power spectrum of the microwave background temperature fluctuations. Determination of the cosmological parameters and the concordance model. Shortcomings of this model and possible alternatives.

Initial competences

This course builds on the compulsory courses "Relativity theory and introduction to elementary paricle physics", "Introduction to astronomy", "Extragalactic astronomy" and "Physics of galaies". The students should have followed

successfully these courses or have acquired their competences in another way.

Final competences

1 Learn to apply the astronomical research method, which is usually based on observations and not on experiments, to this specific topic.
2 Learn how to calculate certain observable quantities within the context of a simple cosmological model.
3 Know how to apply methods drawn from other physical theories (e.g. general relativity or particle physics) to cosmological theories.
4 Gain insight in the limitations of current cosmological theories.
5 Learn to appreciate and communicate the philosophical and social importance of the subject.

Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

Conditions for exam contract

This course unit cannot be taken via an exam contract

Teaching methods

Seminar, Lecture

Extra information on the teaching methods

all students are expected to attempt to solve the exercises at the end of each chapter. Each time, 2-3 students will be appointed to present their solutions during the upcoming exercise class. This way, students can hone their presentation skills before a friendly audience, they are encouraged to learn from each other and to compare different approaches to the problems.

Study material

Type: Syllabus

Name: Syllabus'
Indicative price: Free or paid by faculty
Optional: no
Additional information: Dutch syllabus, downloadable as a .pdf from Ufora. For students who don't know Dutch, a book will be provided as a substitute for the syllabus.

References

Course content-related study coaching

Active support via Ufora and personally on appointment

Assessment moments

end-of-term assessment

Examination methods in case of periodic assessment during the first examination period

Oral assessment, Written assessment, Assignment

Examination methods in case of periodic assessment during the second examination period

Oral assessment, Written assessment, Assignment

Examination methods in case of permanent assessment

Assignment

Possibilities of retake in case of permanent assessment

examination during the second examination period is not possible

Extra information on the examination methods

PE
Theory: partly written, partly oral
Exercises:the students can use the syllabus for this part of the exam
Programming project in Python with written report

Calculation of the examination mark

theory: 8/20
exercises : 7/20
programming project: 5/20