

## History and Philosophy of Sciences: Physics and Astronomy (C003940)

**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 2024-2025**

A (semester 1)

Dutch

Gent

lecture

independent work

**Lecturers in academic year 2024-2025**

Van Dyck, Maarten

LW01

lecturer-in-charge

Beck, Pieter

LW01

co-lecturer

De Rijcke, Sven

WE05

co-lecturer

**Offered in the following programmes in 2024-2025**

[Master of Science in Teaching in Science and Technology\(main subject Physics and Astronomy\)](#)

**crdts**

6

**offering**

A

[Master of Science in Physics and Astronomy](#)

6

A

[Master of Science in Physics and Astronomy](#)

6

A

**Teaching languages**

Dutch

**Keywords**

Philosophy of science, history of science, scientific evidence, scientific models, scientific theories, scientific research communities, expertise, history of physics, history of astronomy

**Position of the course**

This course teaches the student to think about the natural sciences. We investigate some philosophical questions dealing with the relation between theories, models and their empirical evidence. The goal is to give the student insight in both the possibilities and the limits of scientific evidential reasoning by showing the importance of these philosophical ideas for a proper understanding of the history and contemporary practice of the sciences. Next to this, a few developments from the history of physics and astronomy are discussed in more detail.

**Contents**

**General part:** The first part (3 credits, taught in the first six weeks of the semester) introduces the central theme through a study of a few episodes from the history of chemistry that are exemplary for the dynamics of all scientific research. By placing the scientific research in its historical context it is shown how empirical observations can only play their evidential role given a number of "background assumptions". We describe how models are formulated for phenomena, based on these observations, and how these models in turn can be integrated with more abstract theories. The cases discussed are: Lavoisier's oxygen hypothesis, the determination of atomic weights in nineteenth century chemistry, the concept of an element in the table of Mendeleev and the changing relations between chemistry and (sub-)atomic physics.

When describing these cases, we also pay attention to historical evolutions in the organisation of scientific research communities and how these make possible scientific research as a collective endeavor: from the amateurs at the academies of the eighteenth century to the professional scientists at research universities in the nineteenth century and twentieth century (hyper-)specialists. In a concluding class, we discuss the status of expertise in the context of applying scientific theories

when dealing with social problems.

**Domain-specific part.** The second part (3 credits, taught in the next six weeks) focusses on specific aspects from the history of physics and astronomy. The genesis of Newton's classical mechanics is discussed. Further evolutions within mathematical physics in the period after Newton up till the twentieth century are treated. Philosophical questions having to do with the use of mathematical methods in the study of empirical phenomena are also raised. Next to this, an overview is offered of different methods that have been used throughout history by astronomers to determine astronomical distances, with new estimates having often profound impact on our image of the universe.

### Initial competences

Basic familiarity with some central concepts and theories in the natural sciences and physics.

### Final competences

- 1 Being able to correctly explain the relations between empirical evidence, models and theories
- 2 Have insight in the historical developments of scientific research communities and being able to correctly assess the impact of these developments
- 3 Being able to accurately interpret the historical cases
- 4 Being able to develop nuanced reflection on the status of expertise
- 5 Possess knowledge about the historical development of physics and astronomy.
- 6 Have insight in philosophical questions raised by historical developments within physics & astronomy.
- 7 Develop a reflective attitude that can be incorporated in one's own scientific practice.

### 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

Lecture, Independent work

### Study material

Type: Syllabus

Name: Syllabus'

Indicative price: Free or paid by faculty

Optional: no

Additional information: Written syllalubs, scientific papers, historical source-texts, ppt slides

### References

### Course content-related study coaching

The teacher and his collaborators provide individual feedback when necessary.

### Assessment moments

end-of-term and continuous assessment

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

Oral assessment, Written assessment with open-ended questions, Assignment

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

Oral assessment, Written assessment with open-ended questions, Assignment

### Examination methods in case of permanent assessment

### Possibilities of retake in case of permanent assessment

not applicable

### Extra information on the examination methods

General part: Written examination.

Domain specific part: exampaper on a specific topic treated in the classes + oral examination.

**Calculation of the examination mark**

50 % general part and 50 % domain specific part