

Nanomagnetism (C004105)

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

Offering	Language	Location	Teaching Methods
A (semester 1)	English	Gent	lecture seminar independent work
B (semester 2)	English	Gent	lecture independent work seminar

Lecturers in academic year 2024-2025

Van Waeyenberge, Bartel	WE04	lecturer-in-charge
Leliaert, Jonathan	WE04	co-lecturer

Offered in the following programmes in 2024-2025

Programme	credits	offering
Master of Science in Teaching in Science and Technology (main subject Physics and Astronomy)	6	A, B
Master of Science in Physics and Astronomy	6	A, B

Teaching languages

English

Keywords

Magnetism, ferromagnetic and antiferromagnetic materials, spin transport, magnetization dynamics, nano magnets

Position of the course

Advanced course in solid state physics. This course aims at giving the students the basic ingredients to understand the contemporary research going on in the field of magnetism and magnetic nanostructures. Emphasis is laid on research related to activities in Gent.

Contents

- 1 Introduction: Modern magnetism: what, why and how
- 2 Basic concepts of magnetism: magnetic ordering and phase transitions – exchange interaction – magnetic anisotropies - magnetostatics – magnetic microstructure: domains and domainwalls – magnetization dynamics: Landau-Lifshitz-Gilbert equation
- 3 Experimental and computational techniques: Interaction with Light - X-rays – Neutrons, Micromagnetic simulations
- 4 Magnetism on the nanoscale: magnetostatics – magnetic interfaces: exchange bias and magnetic multilayers - magnetization dynamics: spin wave modes – spin dependent transport (GMR, TMR) - spin transfer torque
- 5 Discussion of research papers

Initial competences

Basic knowledge of quantum mechanics, material science, solid state physics.

Final competences

- 1 Acquiring a fundamental knowledge on magnetism and be able to apply it to the field of nano magnetism.
- 2 Understanding the principles of the experimental and computation methods

used to study magnetic systems.

3 Having an overview of the new concepts and challenges in the contemporary magnetism research.

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, Independent work

Extra information on the teaching methods

The lectures and excersissions will be organized in an interactive way. Some session will be used to get in touch with experimental and computational methods.

Study material

Type: Handbook

Name: Magnetism and Magnetic Materials

Indicative price: € 60

Optional: no

Language : English

Author : J. M. D. Coey

ISBN : 978-1-10871-751-9

Number of Pages : 631

Online Available : Yes

Type: Handbook

Name: Magnetism: From Fundamentals to Nanoscale Dynamics, chapter 10

Indicative price: Free or paid by faculty

Optional: no

Language : English

Author : Stöhr, J., Siegmann, H.C.

ISBN : 978-3-54030-282-7

Number of Pages : 40

Online Available : Yes

Type: Slides

Name: Lectures

Indicative price: Free or paid by faculty

Optional: yes

Language : English

Number of Slides : 300

Available on Ufora : Yes

References

Course content-related study coaching

The students can consult the lectures personally and electronically

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, Written assessment open-book

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

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

Examination methods in case of permanent assessment

Presentation

Possibilities of retake in case of permanent assessment

examination during the second examination period is possible

Extra information on the examination methods

Oral examination with written preparation for the theory part (Periodic Evaluation).

Oral presentation of a research paper in front of the peers (Permanent Evaluation)

Calculation of the examination mark

3/4 Periodic Evaluaton + 1/4 Permanent evaluation