GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2024-2025

Nanomagnetism (C004509)

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

Credits 5.0 **Study time 150 h**

Course offerings and teaching methods in academic year 2024-2025

A (semester 2)	English	Gent	seminar	0.0h
			independent work	0.0h
			lecture	0.0h

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	**crdts**	**offering**
Master of Science in Physics and Astronomy	5	A
Exchange Programme in Physics and Astronomy (Master's Level)	5	A

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 contempory research going on in the field of magnetism and magnetic nanostrures. 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 inferfaces: 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 mehtods 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 excersissessions 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

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

Oral assessment, Written assessment

Examination methods in case of permanent assessment

Oral assessment

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 evaluation + 1/4 Permanent evaluation