

PHYS-407

Frontiers in nanosciences

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Cursus	Sem.	Type
Ing.-phys	MA1, MA3	Opt.
Physicien	MA1, MA3	Opt.

Language of teaching	English
Credits	4
Session	Winter
Semester	Fall
Exam	Oral
Workload	120h
Weeks	14
Hours	4 weekly
Courses	2 weekly
Exercises	2 weekly
Number of positions	

Summary

The course covers relevant experimental and theoretical concepts in nanoscale science, from fundamental aspects like quantum tunneling and quantum size effects, to hot topics like quantum transport and nanoscale magnetism.

Content

Review of electronic properties: from atoms to bulk
 Confinement of electronic states
 Imaging and manipulation at the atomic scale
 Making the nanostructures: top-down and bottom-up approaches
 Advances in field-effect transistors (FETs): solid state devices (SSD), 2D-FETs
 Quantum transport in 1D, and in 0D (single-electron FET)
 Magnetism at the nanoscale: magnetic data storage (HDD), introduction to spintronics

Learning Prerequisites**Recommended courses**

Solid state physics

Learning Outcomes

- Explain the differences between nanoscopic and macroscopic scale
- Analyze the results of a scientific experiment
- Design a scientific experiment

Transversal skills

- Summarize an article or a technical report.
- Access and evaluate appropriate sources of information.
- Use a work methodology appropriate to the task.

Teaching methods

Ex cathedra with exercises in class

Assessment methods

oral exam (100%)

Supervision

Office hours	No
Assistant.e.s	No
Forum	No

Resources

Bibliography

For each subject, relevant bibliography will be indicated on the slides, available on Moodle

Notes/Handbook

Lecture slides will be available on Moodle

Websites

- <http://moodle.epfl.ch/course/view.php?id=7781>

Moodle Link

- <https://go.epfl.ch/PHYS-407>