PHYS-420 **Solid state physics IV**

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Cursus	Sem.	Type
Ing.-phys	MA2, MA4	Opt.
Physicien	MA2, MA4	Opt.

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

Summary

Solid State Physics IV provides a materials and experimental technique oriented introduction to the electronic and magnetic properties of strongly correlated electron systems. Established knowledge is complemented by current research trends, aiming to prepare the students for independent research.

Content

1. Brief Introduction to Scattering and spectroscopic methods
- Neutron scattering
- X-ray scattering
- Electron scattering
- Angular resolved photoemission and optical spectroscopy
- out of equilibrium experiments

2. Bulk methods
- Transport, specific heat and susceptibility

3. Strongly correlated electron materials
- Transition metal oxides
- Cuprates: high-temperature superconductivity
- manganites: colossal magnetoresistance

4. Introduction to quantum magnetism
- Low-dimensional magnetism
- Rare-earth magnetism
- Quantum phase transitions

Learning Prerequisites

Recommended courses

Solid state physics I and II or the equivalent to one of the book Aschroft & Mermin or Kittel

Learning Outcomes

By the end of the course, the student must be able to:

- Decide which experimental technique is suited to investigate a certain phenomenon or property
- Interpret experimental data in the context of phenomena encountered during the course
- Sketch the key electronic and magnetic properties of transition metal material classes

Transversal skills

- Make an oral presentation.
- Summarize an article or a technical report.

Teaching methods

Lectures, exercises, visit to Paul Scherrer Institut

Assessment methods

oral exam (100%)

Resources

Ressources en bibliothèque

- Transition metal compounds / Khomskii

Websites

- http://lqm.epfl.ch/

Moodle Link

- https://go.epfl.ch/PHYS-420