

PHYS-420

**Solid state physics IV**

Carbone Fabrizio

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
<b>Hours</b>	<b>4 weekly</b>
Lecture	2 weekly
Exercises	2 weekly
<b>Number of positions</b>	

**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 Ashcroft & 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>