

PHYS-309

Solid state physics I

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Cursus	Sem.	Type
Physics	BA5	Obl.

Language of teaching	English
Credits	3
Session	Winter
Semester	Fall
Exam	Written
Workload	90h
Weeks	14
Hours	3 weekly
Courses	2 weekly
Exercises	1 weekly
Number of positions	

Summary

This lecture gives an introduction to Solid State Physics, namely to their crystal and electronic structure, their magnetic properties, as well as to their thermal and electric conductance. The level is that of the book by Ashcroft & Mermin. The lecture is for Physics Students in their 3rd year

Content

The Drude model of metals: DC electrical conductivity, Hall effect, AC electrical conductivity, thermal conductivity.

The Fermi free electron gas: ground-state and thermal properties of the free electron gas, Pauli paramagnetism, Sommerfeld theory of conduction in metals.

Electrons in a periodic potential: the emergence of electronic bands, Bloch's theorem, distinction between metals and insulators, strong coupling approximation.

Dynamics of band-electrons: conductivity, effects of magnetic fields

The lecture is accompanied by an introduction to crystallography in real and reciprocal space.

Learning Outcomes

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

- Sketch the lattice in real and reciprocal space
- Argue about the number of k-points in the first Brillouin zone
- Compute the electrical conductivity
- Compute the specific heat of electrons
- Explain Bloch's theorem
- Explain Fermi energy and fermi sea

Transversal skills

- Use a work methodology appropriate to the task.
- Communicate effectively with professionals from other disciplines.

Teaching methods

Ex cathedra and exercises in class

Assessment methods

Take home exam

Resources

Bibliography

Polycopies in French on moodle
Ascroft and Mermin: Solid State Physics

Ressources en bibliothèque

- [Ascroft and Mermin: Solid State Physics](#)

Prerequisite for

Solid State Physics II, III and IV