PHYS-419 Solid state physics III

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Cursus	Sem.	Туре	Language of	English
Ingphys	MA1, MA3	Opt.	teaching	English
Physicien	MA1, MA3	Opt.	Credits Session Semester	6 Winter Fall
Quantum Science and Engineering	MA1, MA3	Opt.		
			Exam	Oral
			Workload	180h
			Weeks	14
			Hours	5 weekly
			Lecture	3 weekly
			Exercises	2 weekly
			Number of	-
			positions	

Summary

The aim of this course is to provide an introduction to the theory of a few remarkable phenomena of modern condensed matter physics ranging from the quantum Hall effects to superconductivity.

Content

Magnetism of insulators

- Review of band theory
- Mott insulators and Hubbard model
- Heisenberg model
- Spin-wave theory of ferromagnets and antiferromagnets

Orbital magnetism of metals and semiconductors

- Landau levels
- De Haas-Van Alphen and Shubnikov-de Haas oscillations
- 2D electron gas: Integer and fractional Quantum Hall effects

Theory of superconductivity

- Electron-phonon interaction
- BCS theory
- Landau-Ginsburg theory
- Flux quantization and Josephson effect

Learning Prerequisites

Recommended courses

Good grasp of quantum mechanics and solid state physics say at the level of "Lectures on quantum mechanics" by Gordon Baym and "Solid state physics" by Ashcroft and Mermin

Learning Outcomes

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

• Explore the quantum properties of solids and synthetic many body systems

Transversal skills



- Access and evaluate appropriate sources of information.
- Continue to work through difficulties or initial failure to find optimal solutions.

Teaching methods Ex cathedra. Exercises in class

Assessment methods oral exam

Resources Bibliography Lecture notes

Prerequisite for Solid state physics IV