

"Ultrafast experiments of solids: microscopic details on photoexcitation processes".

In this lecture, the basic concepts of ultrafast experiments will be discussed. After a general discussion on the different possible sources for time-resolved studies, the focus will be put on electro-magnetic driven phenomena. Because of the possibility to reach the sub-fs regime with light, the microscopic origin of the photoexcitation processes in materials will be discussed in more detail, but other control parameters like magnetic field, particle radiation dose and carrier concentration will be discussed.

The basic theoretical models for the interaction between electromagnetic fields and matter will be discussed. The aim of this discussion will be to identify the processes that can lead to the generation and timing of time-evolving phenomena in solids.

In the second part of the lecture, different possible ultrafast probe processes will be discussed with an emphasis on infrared and visible light photons, high energy electrons and neutrons.

Practical examples will be used throughout the lecture involving different phenomena of interest for condensed matter physics like structural phase transitions, superconductivity and charge density waves.