

## **Ultrafast Electron Microscopy: Physics and Chemistry on the Nanometer and Picosecond Timescale**

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Nanoscale objects may undergo transformations within nano-, pico-, or even femtoseconds. To obtain detailed information about these transformations, we need characterization tools with high spatial as well as high temporal resolution. This goal is now approached by a combination of electron microscopy and laser optics. Laser pulses allow to generate ultrashort electron pulses that serve as probes in an electron microscope. Hence, instead of using continuous electron beams like in conventional electron microscopy, imaging as well as diffraction or electron energy-loss spectroscopy can now be carried out with short electron pulses. A pump-probe approach is used where a laser pulse that induces a certain transformation in a nanosystem is followed by an electron pulse that provides information about the temporal evolution of the object. This technique is now available in a new instrumentation that has been developed within an Equipex program at the IPCMS. Many applications in physics, chemistry, and materials science are awaiting their investigation with this modern technique of nanocharacterization. The course will give an introduction into this exciting new field.

### **Topics of the course:**

1. Introduction
2. The interaction of materials with electron and photon beams
3. The principles of electron microscopy
4. Ultrashort laser pulses
5. Laser-controlled electron microscopy
6. Stroboscopic and "single-shot" experiments
7. Potentials and applications of ultrafast electron microscopy

### **Dates:**

12/04, 17/05, 22/05, 31/05, 7/06/2018 in the auditorium of the IPCMS from 14:00 to 16:00 and 14/06/2018 in room 74 of the IPCMS from 14:00 to 16:00