

## Near Field Probes for the Nanosciences

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The course will give an account on the theoretical and experimental aspects of this approach providing unique access to electronic properties at the nanoscale. Whenever required, notions of thermodynamics, electronic theory and crystallography of surfaces will be introduced from scratch. More classical methods, will sometimes be introduced as the basic premises to the presentation of local probe techniques.

The lecture will be illustrated by numerous examples of the scientific literature and should enable a glimpse at the fascinating challenges in the field of the nanosciences. Opportunities will be given to describe the complex mechanisms that are at the origin of the growth of nano-objects on surfaces by self-organization. These include understanding the stability of aggregates by means of simple atomistic models. Finally, making use of the spectroscopic ability of local probes, we will describe how to access magnetic, optical and superconducting properties of molecules, clusters and nanoparticles on surfaces. Special attention will be devoted to the interaction of these objects with their environment.

### Main topics:

- Theoretical background of scanning tunneling microscopy & spectroscopy
- Physics at surfaces, ultrahigh vacuum and low temperatures
- Atomic manipulation,
- Quantum confinement & size effects,
- Charge density waves and superconductivity,
- Molecular electronics,
- Spin-polarized probes & applications,
- Atomic force microscopy,
- Magnetic force detection,
- Hysteresis and magnetic domains at the nanoscale,
- Near field optical microscopy & plasmonics,
- Chemisorption and catalysts.

**Time:** 16, 23, 29 Mai and 6, 13, 20, 27 June 2019 from 14:00 to 16:00

**Place:** Auditorium IPCMS, 23 rue du Loess, Strasbourg

