

Microscopic and spectroscopic techniques for the analysis of surfaces and interfaces

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Microscopy (10 hours)

1. (3/4 hours) - Atomic force microscopy (AFM).

Principles of operation and general information, atomic and molecular scale imaging (Contact-AFM; Amplitude Modulation - AFM; Non Contact-AFM), mechanical analysis of surfaces and nanoscale systems (C-AFM; Lateral Force Microscopy), local electrical properties (Conductive AFM, Kelvin Probe Microscopy KPM)

2. (3/4 hours) – Scanning Tunnelling Microscopy (STM).

Operation principles, imaging and spectroscopy at the atomic/nanometric scale of metals, semiconductors and superconductors, imaging and spectroscopy of metallosemiconductor junctions (Ballistic Electron Emission Microscopy)

3. (2/4 hours) Practical demonstration in the laboratory.

Spectroscopy (10 hours)

4. (3 hours) Photoemission spectroscopy. Fundamental principles, experimental laboratory equipment (photon sources, analyzer of electrons). X-ray photoemission: core level analysis, semi-quantitative analysis of spectra, core-level shifts. , UV ray photoemission. Photoemission techniques with synchrotron light: Photoemission at Cooper minimum, threshold spectroscopies. Examples of applications.

5. (2 hours) Laboratory demonstration (XPS)

6. (2 hours) Auger spectroscopy. Fundamental principles and generalities. Qualitative and semi-quantitative analysis of spectra. Examples of applications.

7. (2 hours) Didactic laboratory (Auger spectroscopy).

8. (1 hour) Introduction to vibrational spectroscopy.