

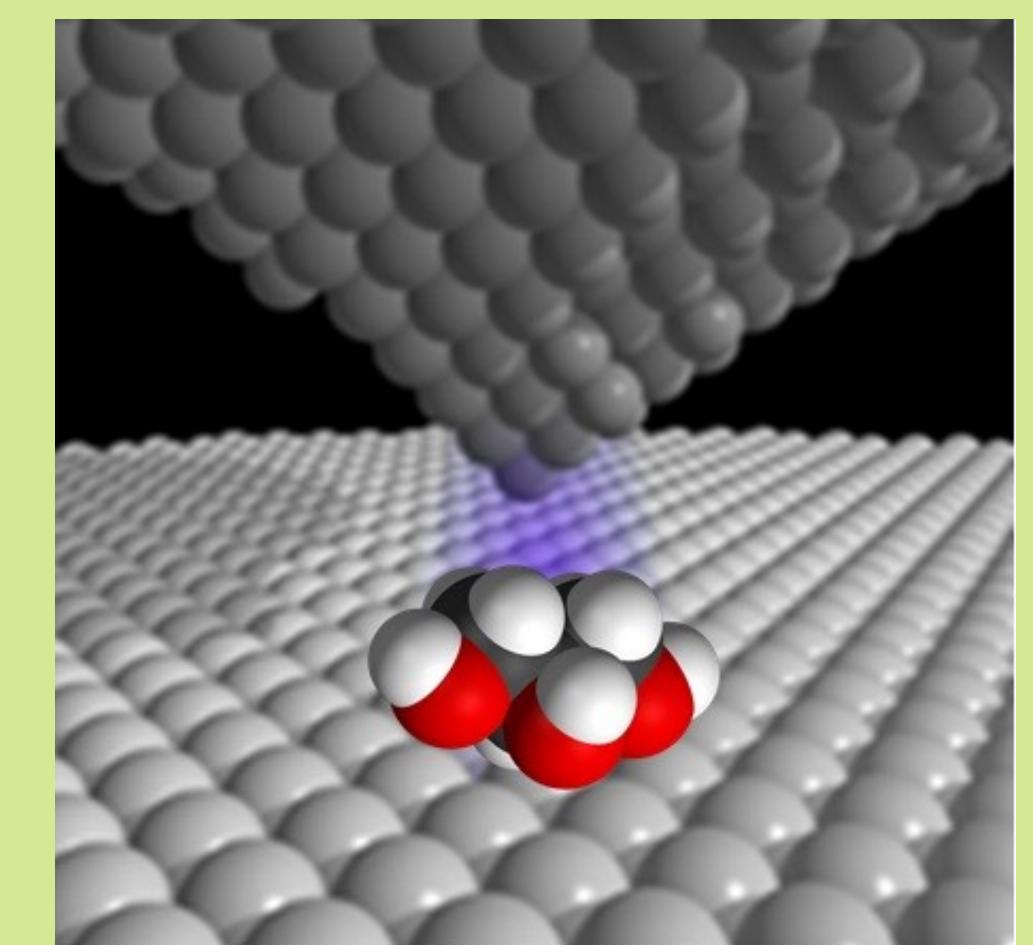
AFM and SPFM atomic- and nanometer-level characterization and HV and UHV “MBE”-type pulsed laser depositions



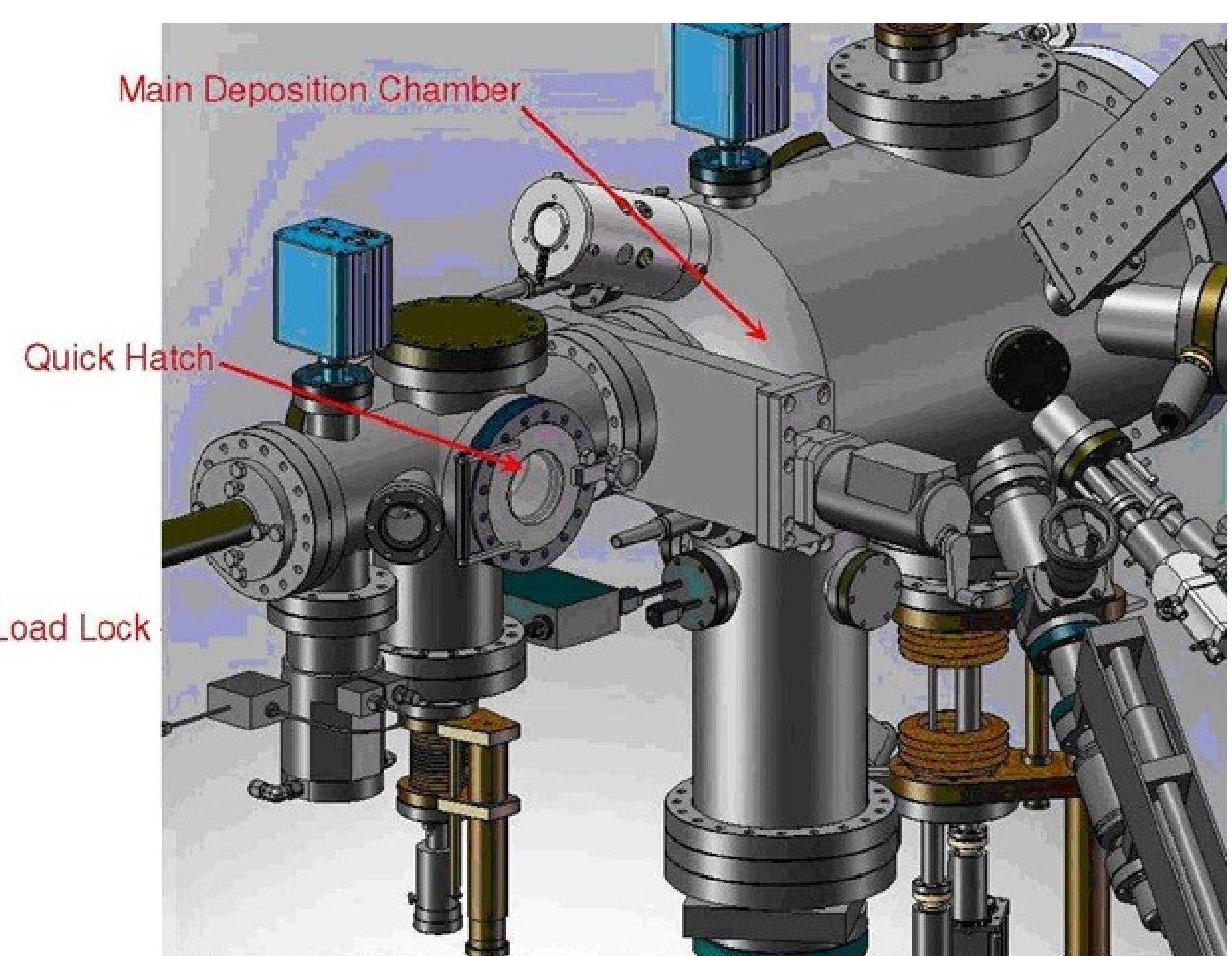
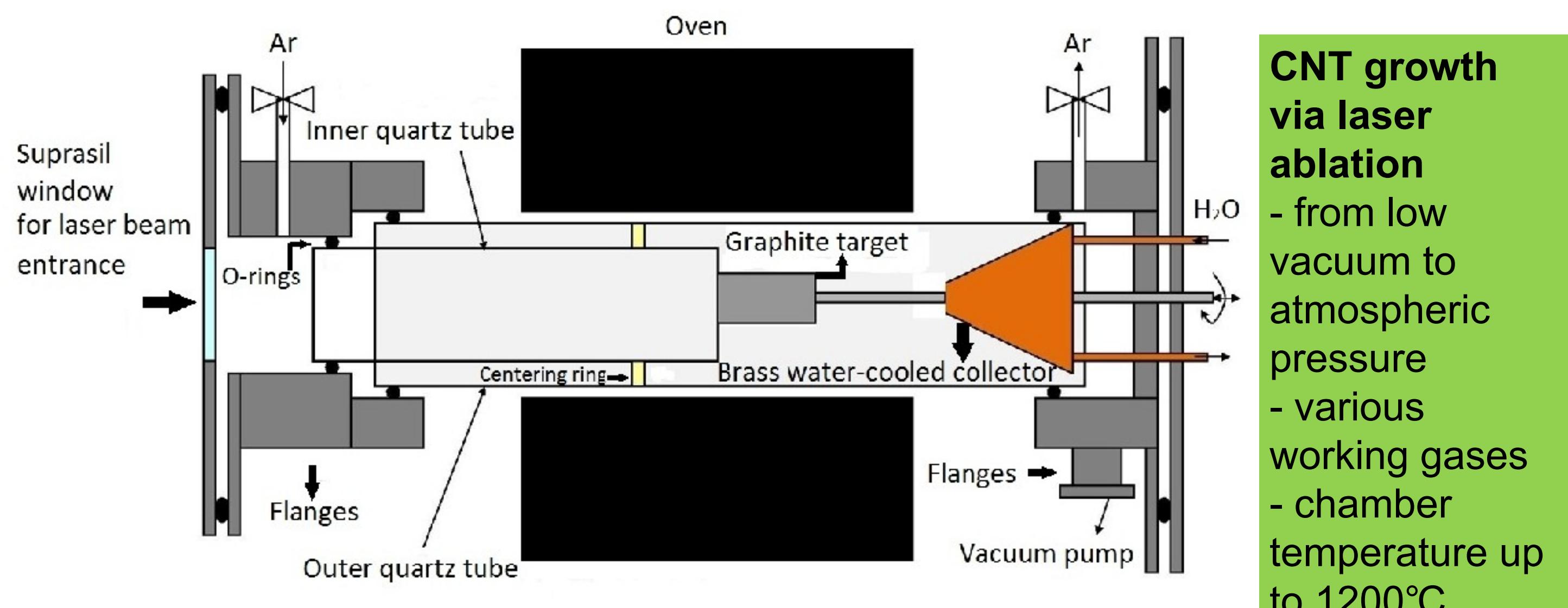
www.imt.ro/NANOPROSPECT

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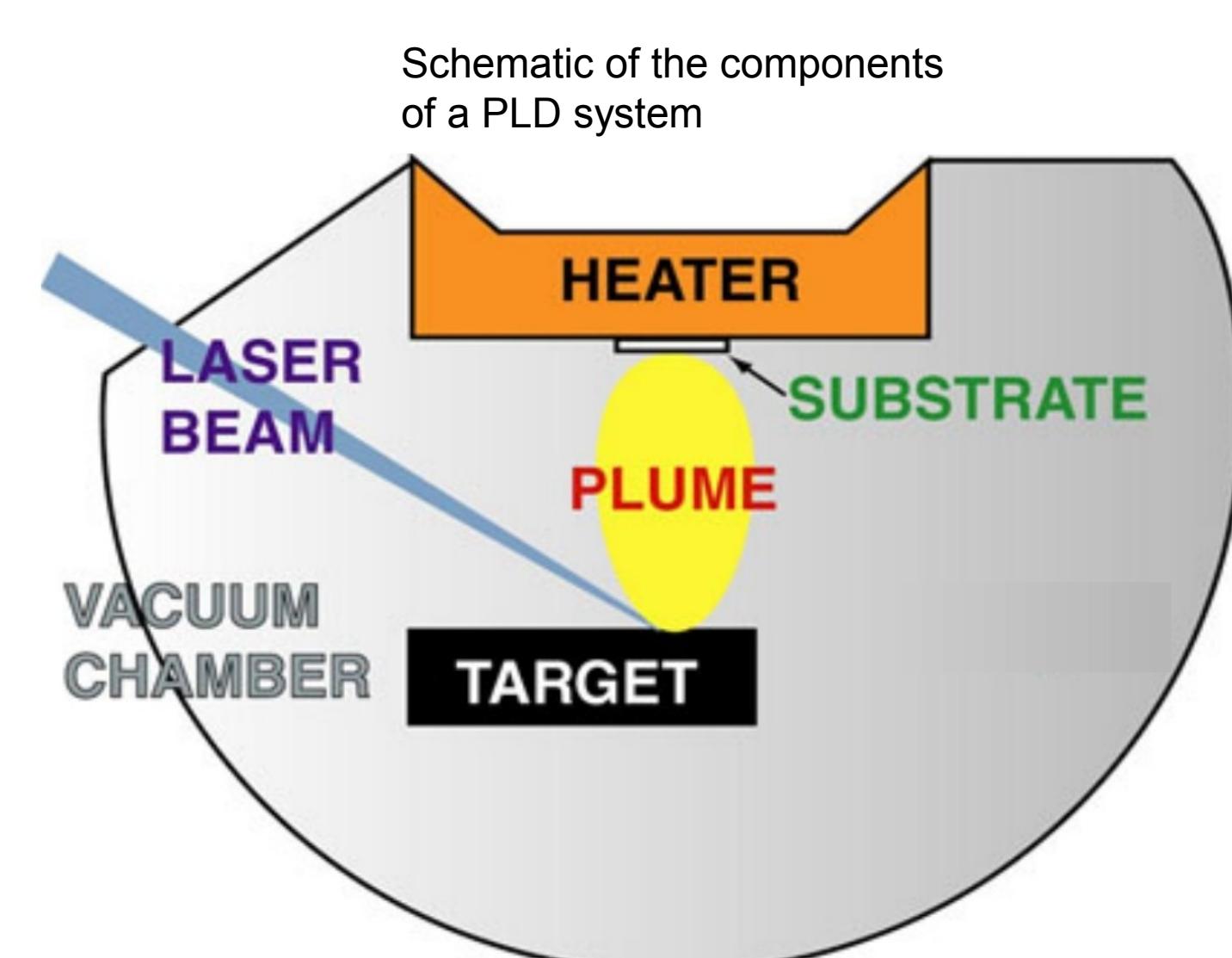


Materials processing



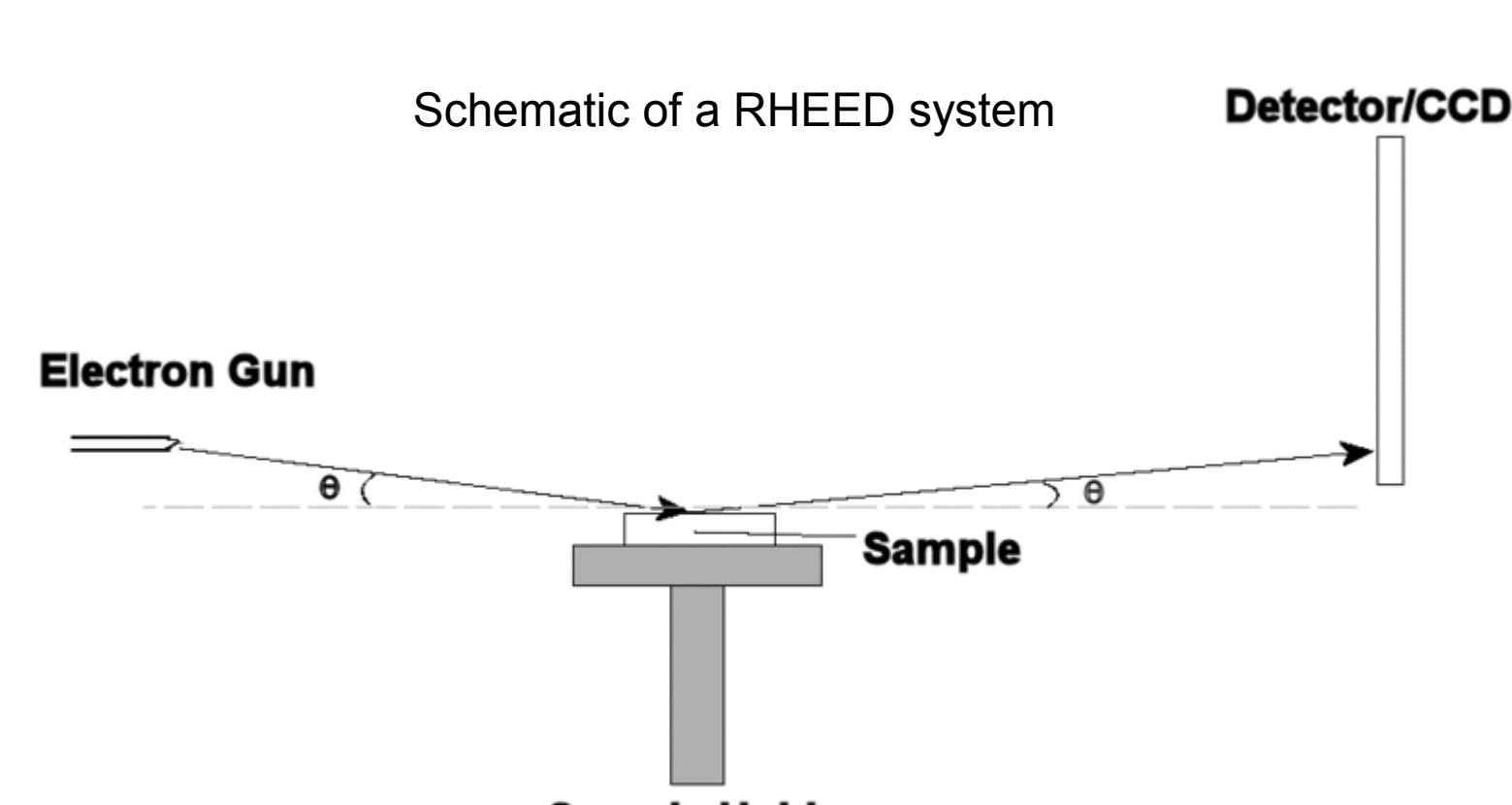
“MBE”-type thin films deposition via laser ablation (HV and UHV)

- deposition of various materials in a layer-by-layer fashion
- deposition of reactive surfaces in UHV
- various working gases
- differentially pumped load-lock chamber with magnetic manipulation arm
- base pressure 5×10^{-10} torr
- sample heating up to 1000°C



Laser source:

- excimer laser
- 248 nm wavelength
- pulse energy 700 mJ
- pulse duration (FWHM) 25 ns
- repetition rate 1-50 Hz



In situ RHEED (Reflection High-Energy Electron Diffraction) characterization

- up to 500 mtorr in O₂ atmosphere, during PLD
- real time monitoring of layer-by-layer growth
- monitoring the chemical composition of deposited materials

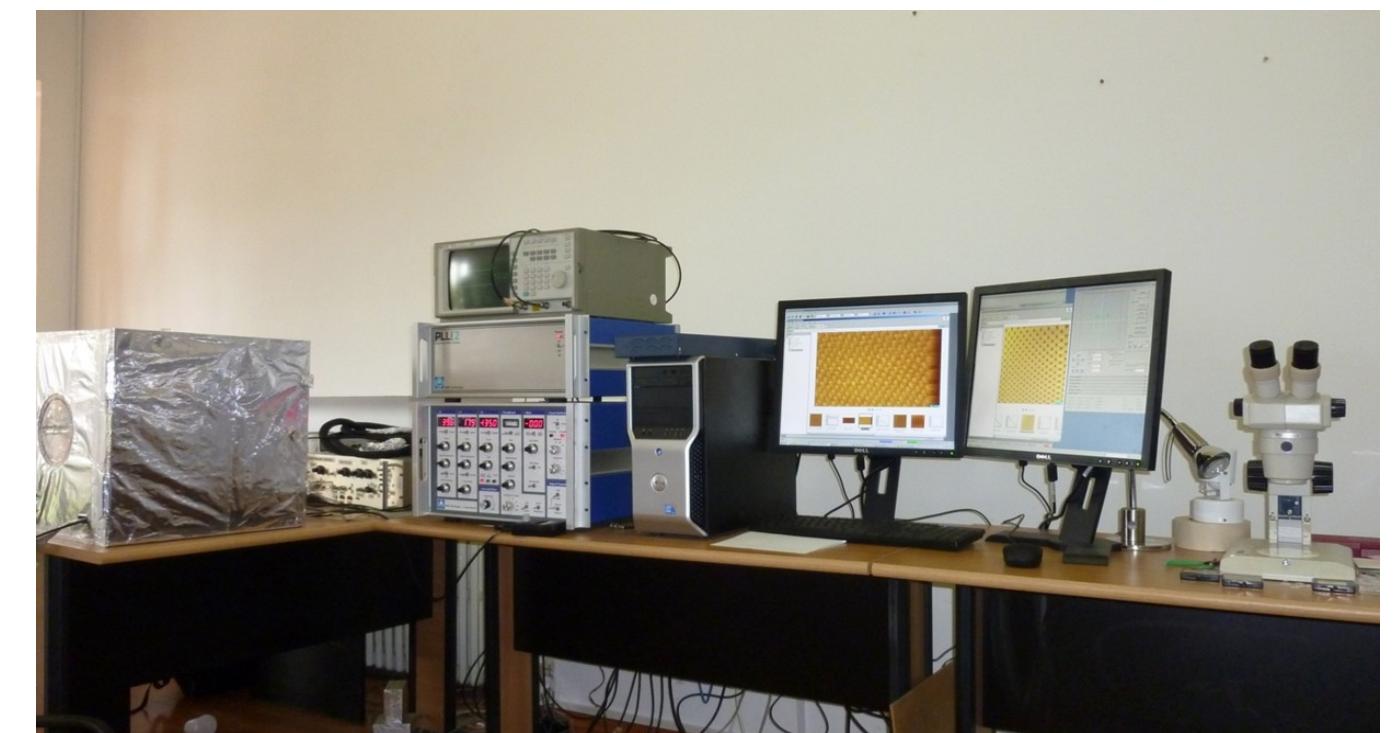
AFM

- atomic resolution in air and controlled environment
- topography, roughness etc.
- nano-tribology, nano-conductance: friction mapping and conductivity mapping
- adhesion forces, adhesion energy and iso-adhesion mapping

Materials characterization

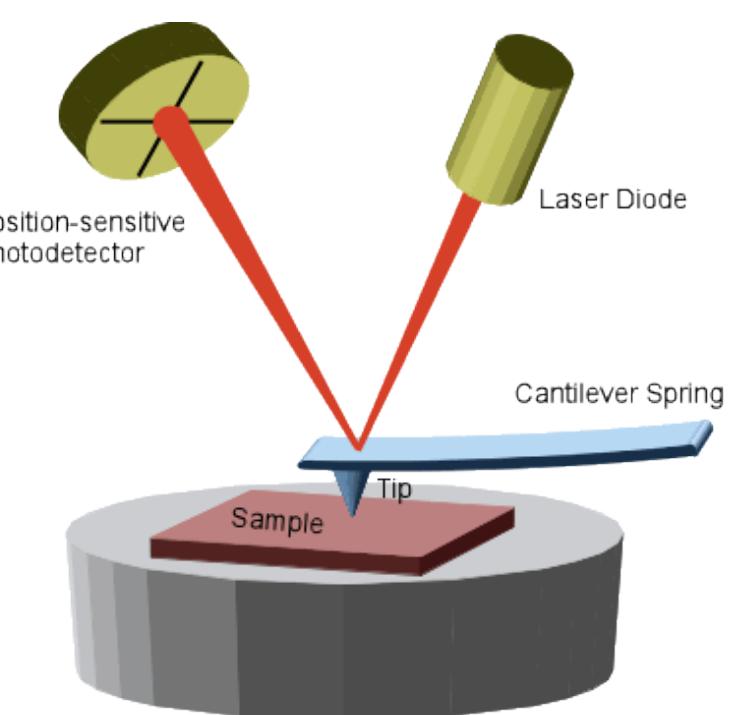
Scanning Probe Microscopy (SPM) system

- Atomic Force Microscopy (AFM)
- Scanning Polarization Force Microscopy (SPFM)
- Scanning Tunneling Microscopy (STM)

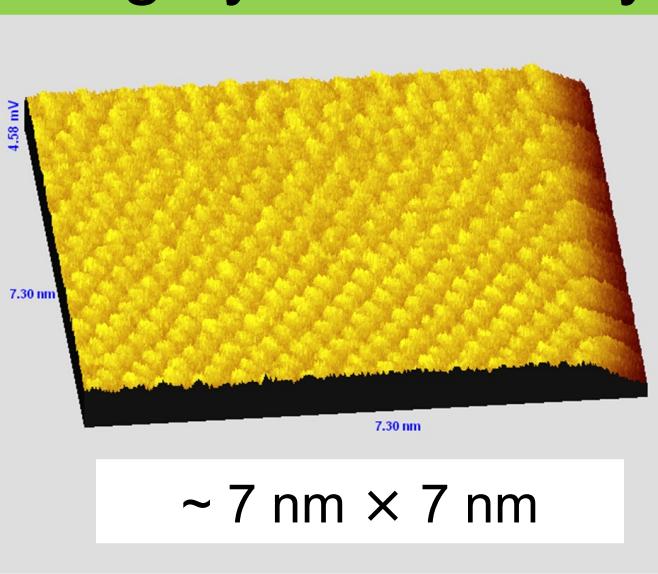


AFM

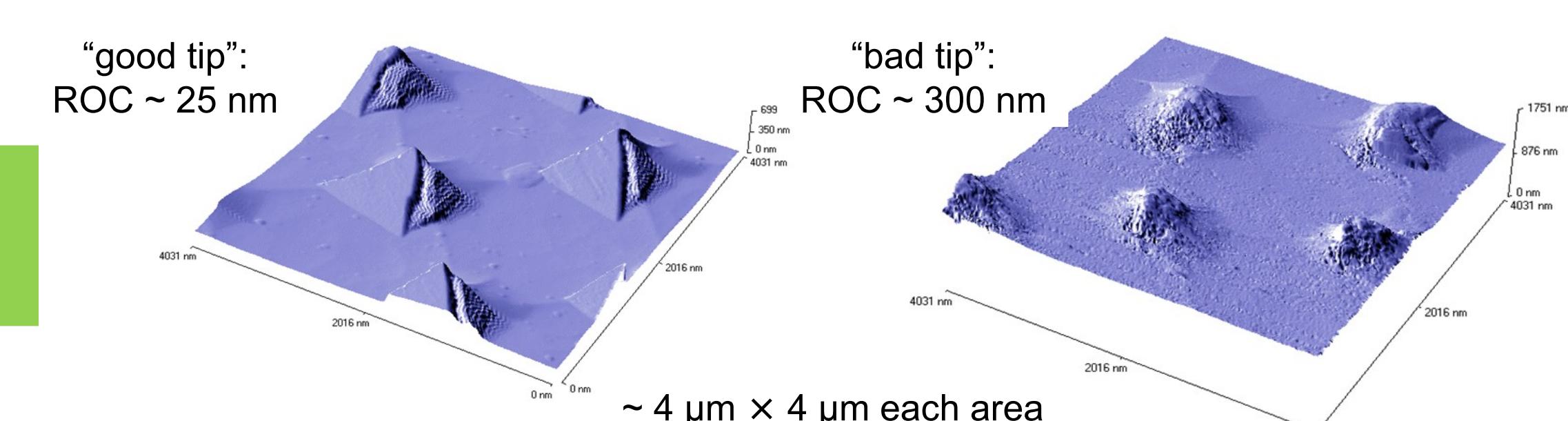
- optical lever detection system
- lateral resolution far beyond diffraction limit (0.5 nm)
- vertical resolution < 0.01 nm
- virtually no sample preparation needed
- highly versatile system



AFM: atomic resolution on MICA

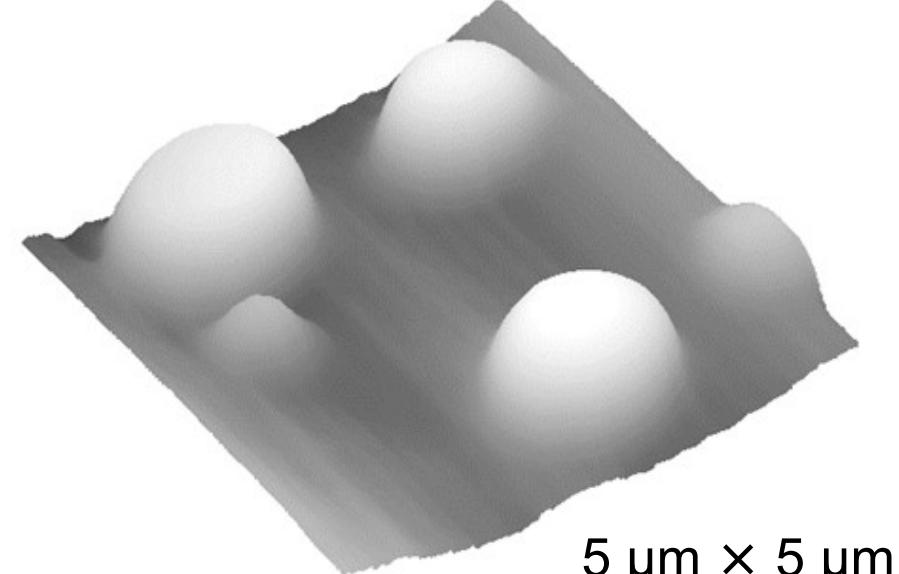
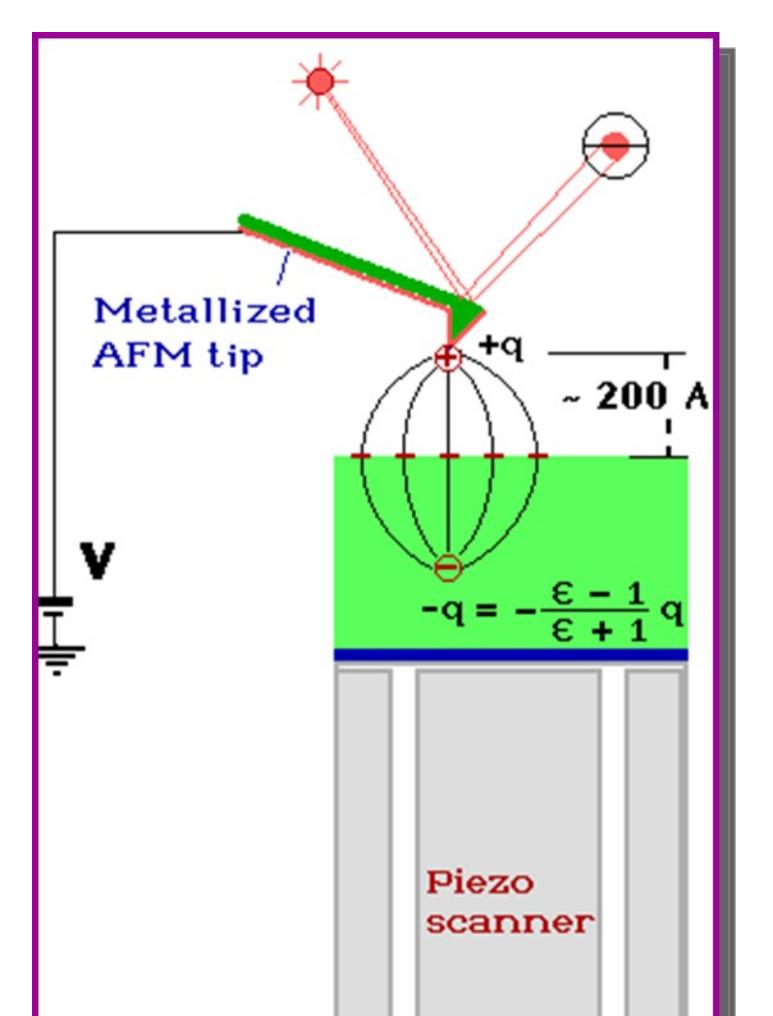


AFM: tip radius measurements



SPFM

- vertical resolution 0.01 nm
- lateral resolution ~ a few nm
- mechanical modulation: ω_{res} → surface topography
- electrical modulation: ω → surface contact potential mapping
- electrical modulation: 2ω → dielectric constant mapping

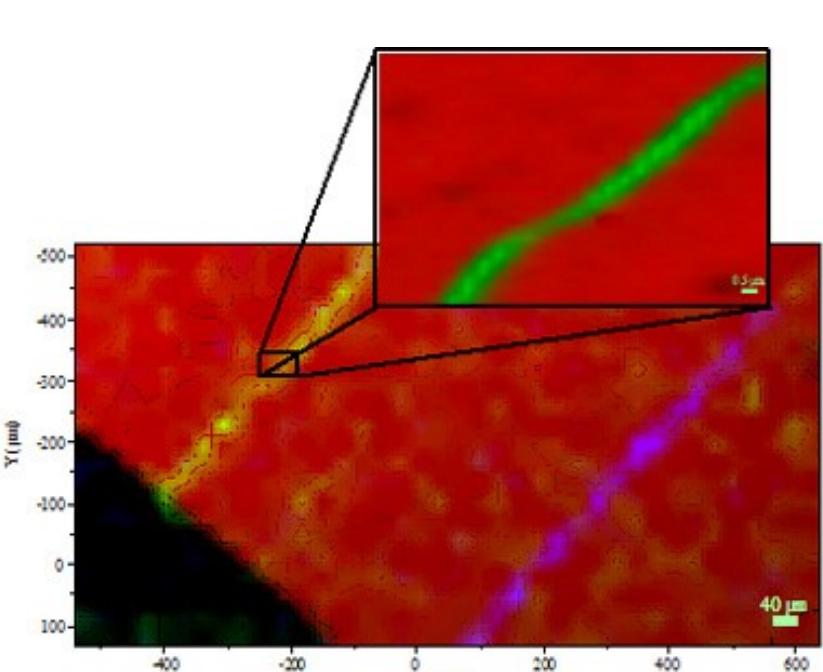


SPFM: glycerol droplets



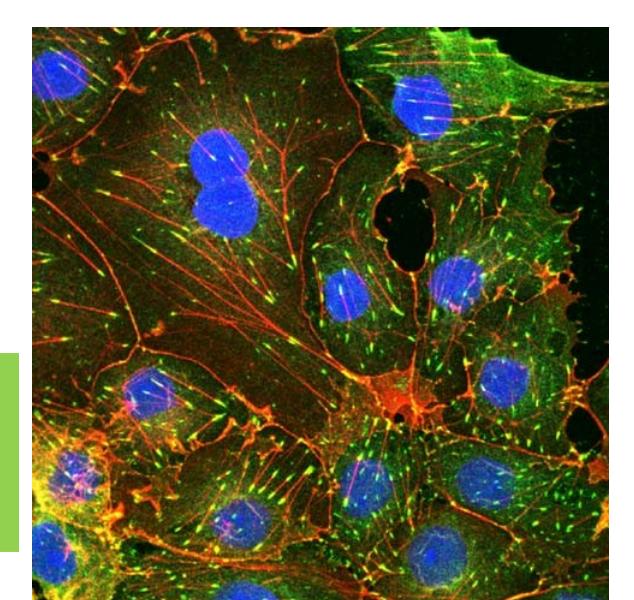
Confocal Raman Microscopy - Horiba

- Raman Spectroscopy
- Confocal Fluorescence Microscopy
- Tip-Enhanced Raman Spectroscopy (TERS) – development in progress



Isolated SWCNTs aligned on a Silicon sample: red - integrated intensity of the Si band; green and blue - respective G bands of the CNTs (www.horiba.com)

Confocal fluorescence microscopy of focal adhesion and actin cytoskeleton in COS-7 cells (www.horiba.com)



“MBE”-PLD

- in high pressure: up to 500 mtorr
- in HV: $10^{-5} - 10^{-6}$ torr
- in UHV: 10^{-10} torr

SPFM

- imaging of soft materials and liquids
- 0.01 nm vertical resolution; a few nm lateral resolution
- contact angle and wetting processes
- simultaneous topography, contact potential mapping and dielectric constant mapping of the surface