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Atomic Force Microscopy (AFM)

Looking at atoms with force interaction

Follow us

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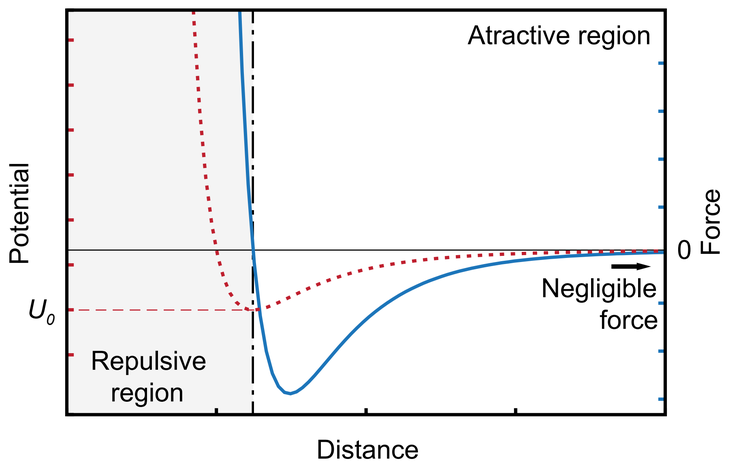
Non Contact Atomic Force Microscopy (ncAFM)

- Tip oscillates without direct contact with the substrate
- Change of the resonant frequency as a result of tip-sample forces

What type of forces??

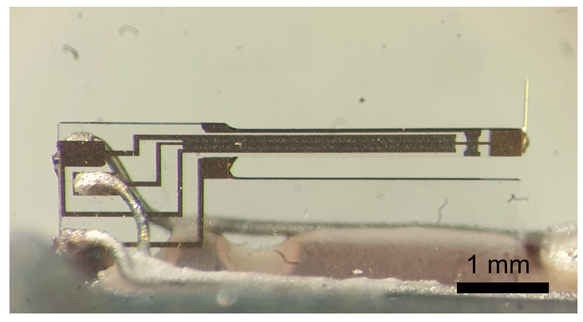
- **vdW** forces
- **Pauli** repulsion
- **electrostatic** interactions
- **magnetic** interactions

$$d\omega \sim -\nabla F$$



qPlus sensor

- Tuning fork based
- 1st generation from wristwatch tuning fork
- High stiffness



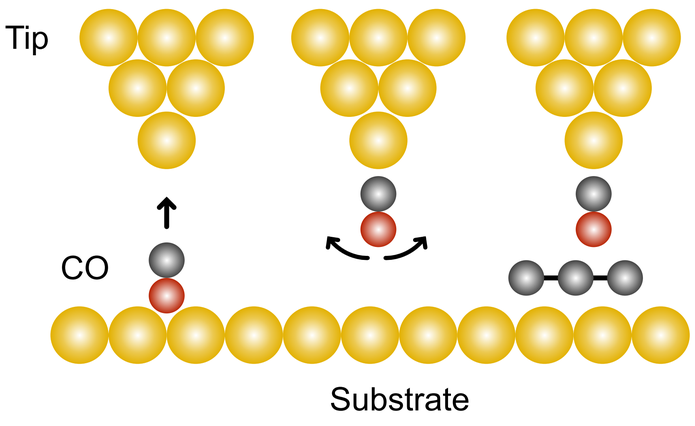
A ≈ 20 -100 pm

ω ≈ 30 000 Hz

Q ≈ 40 000 -100 000

Submolecular resolution

Carbon monoxide tip functionalization



L. Gross et al., Science 325, 1110 (2009)

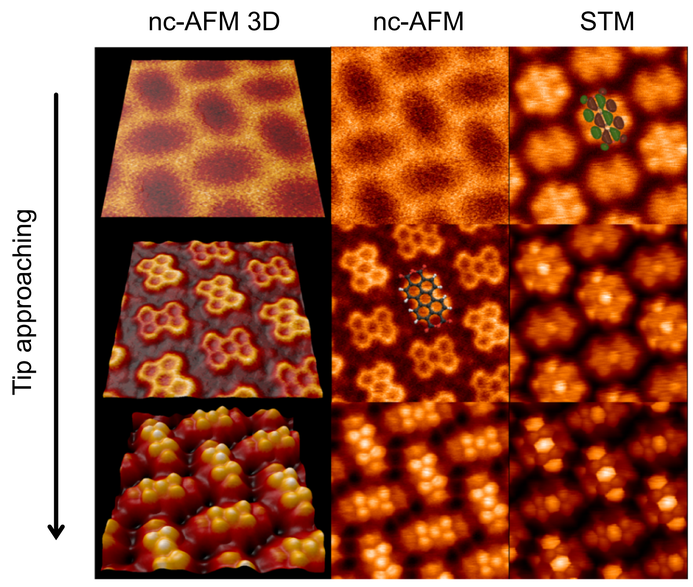
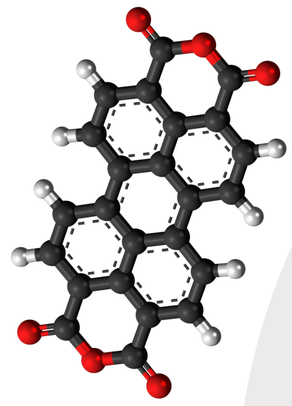
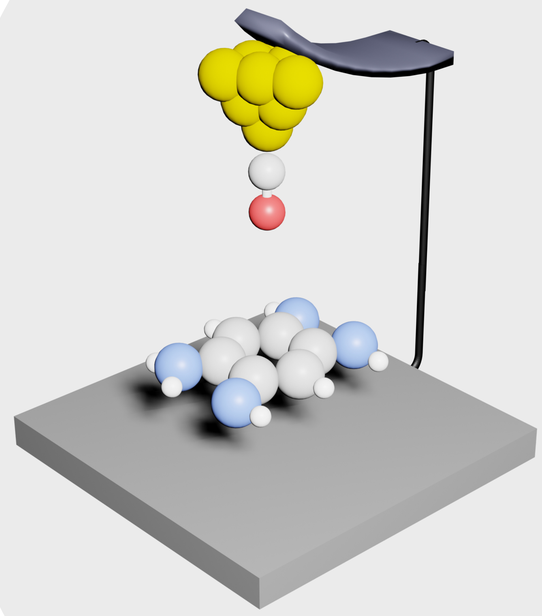


Image provided by courtesy of Dr. Martin Svec

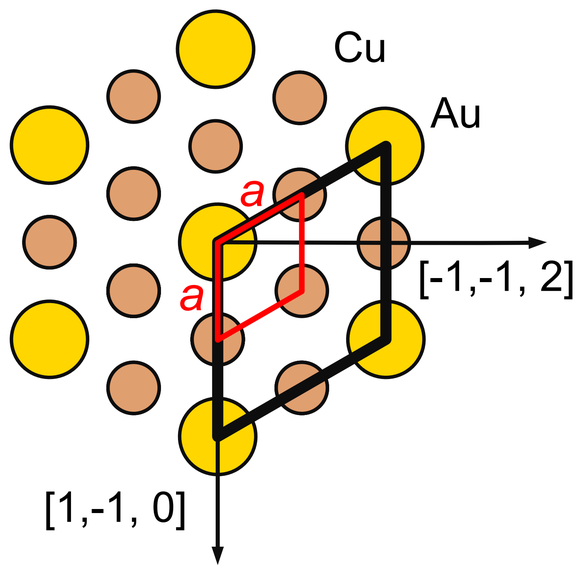
Example **PTCDA** molecule

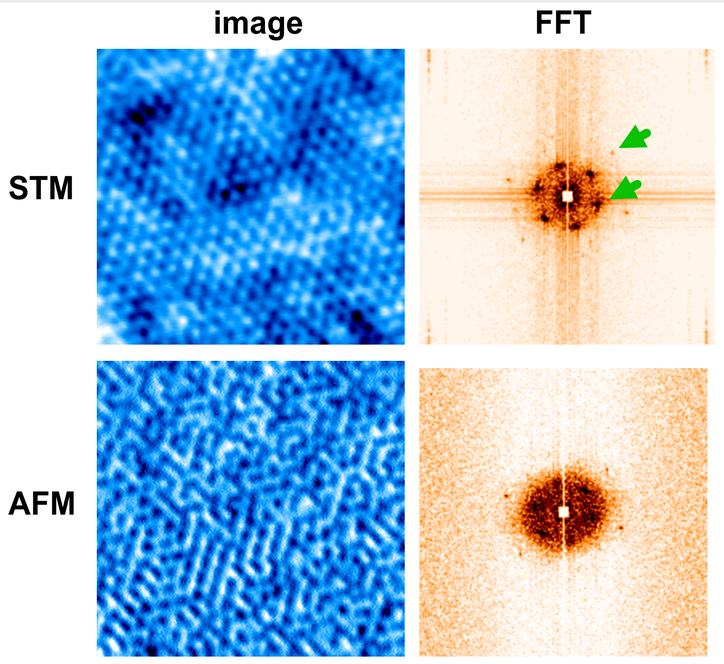




Surface structure determination

Cu_3Au (111) Ordered Phase





Atomic resolution

CO functionalization

Visible both Au and Cu lattices

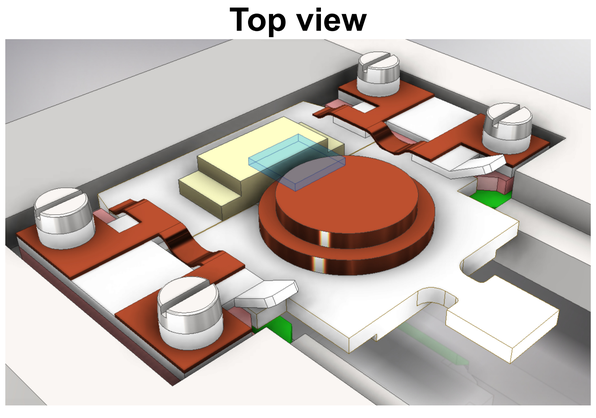
Maze-like contrast in nc-AFM

Aleš Cahlík *et al.*, arXiv:2208.05760 (2022)

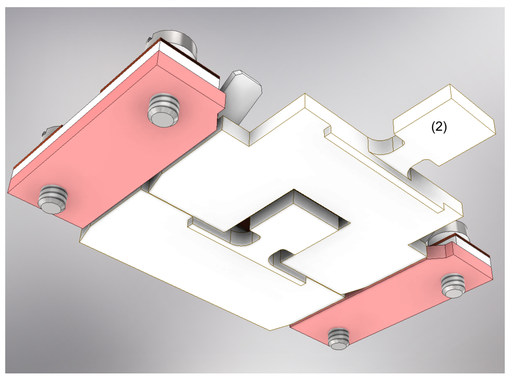
Dual Sample Holder

- Two different samples in the microscope head
- Investigation of variety of materials (insulators, semiconductors, superconductors)
- Easy solution for tip functionalization

Top view

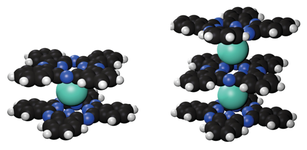


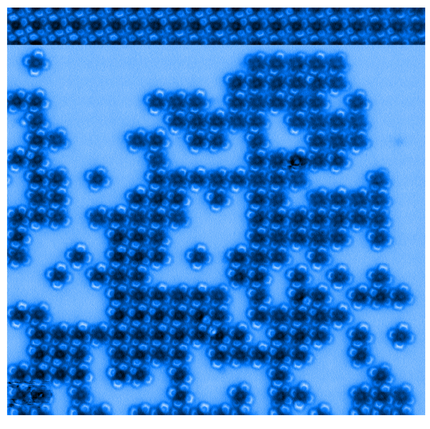
Bottom view

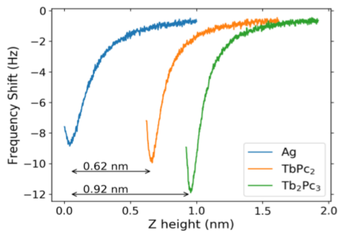


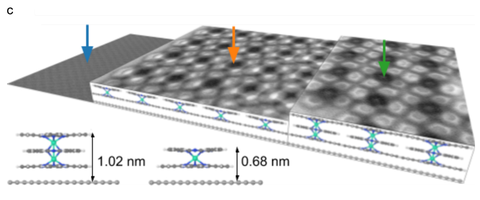
Single Molecule Magnets

- Investigation of Single Molecule Magnets (SMM)
- Double-decker terbium complexes
- Extracting height information
- High resolution imagining









Aleš Cahlík *et al.*, Nanoscale 10 (33)