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Towards Obtaining Ultimate Resolution with Atomic Force Microscopy NIKOLAJ MOLL, LEO GROSS, FABIAN MOHN, ALESSANDRO CURIONI, GERHARD MEYER, IBM Research - Zurich — To increase the resolution of surface microscopy is one of the most significant goals of surface science. The resolution of atomic force microscopy (AFM) is critically defined and scaled by the radius of the AFM tip. Ultimate resolution can be achieved by functionalizing the tip with a molecule like carbon monoxide with the tip molecule significantly contributing to the measured force. The force and therefore the resolution crucially depends on the chemical nature of the terminating tip molecule. In this work molecules such as pentacene are imaged with unprecedented resolution by employing such functionalized tips. The interactions of the tip molecule with imaged molecule are studied with ab initio density functional theory (DFT) calculations. The calculations show that Pauli repulsion is the source of the high resolution, whereas van-der-Waals and electrostatic forces only add a diffuse attractive background. This enhancement of the resolution is also observed experimentally and compares very well with the theoretical findings.

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