

**Non-additivity of Molecule-surface van der Waals Potentials from Force Measurements and
Reconstruction of the Surface Holding potential**

Stefan Tautz

Forschungszentrum Jülich, Germany

Email of Presenting Author: s.tautz@fz-juelich.de

Van derWaals (vdW) forces act ubiquitously in condensed matter. Despite being weak on an atomic level, they substantially influence molecular and biological systems due to their long range and system-size scaling. The difficulty to isolate and measure vdW forces on a single-molecule level causes our present understanding to be strongly theory based. Here we show measurements of the attractive potential between differently sized organic molecules and a metal surface using an atomic force microscope. Our choice of molecules and the large molecule-surface separation cause this attraction to be purely of vdW type. The experiment allows testing the asymptotic vdW force law and its validity range. We find a superlinear growth of the vdW attraction with molecular size, originating from the increased deconfinement of electrons in the molecules. Finally, we are also able to reconstruct the short range part of van der Waals potential, yielding the complete surface holding potential of the molecule.