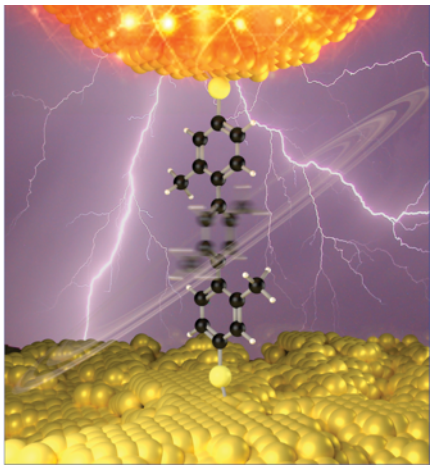
Probing assembly, vibrational excitations and switching at the molecular level

Johannes Barth

Physics Department E20, Technical Universtiy of Munich
jvb@tum.de

The control and organization of molecular species is key to advance molecular science, organic (opto)electronics, nanophotonics, and the development of novel functional materials. We notably explore interfacial bonding, assembly and dynamic behaviour at well-defined homogenous surfaces, textured templates and sheet layers. The experimental methodology relies on using scanning probe microscopy, molecular junction spectroscopy and complementary techniques, as well as computational modeling. The developed bottom-up fabrication protocols employ biological and *de novo* synthesized building blocks, while implementing error-corrective supramolecular bonding schemes as well as covalent chemistry. We thus advance the interfacial control of single molecular units and the design of nanoarchitectures with special structural features, intricate dynamics and tailored properties. Also chemically sensitive techniques for single-molecule electronics are described, addressing the fundamental challenge to quantitatively determine charge-vibrational coupling in well-defined molecular junctions. We thus explore current-carrying tethered molecules by combined vibrational and metal-molecule-metal junction current-voltage spectroscopy and the conformational response of molecular switches.



Key References:

Acc. Chem. Res. 51, 365 (2018); JACS 140, 4835 (2018); Nat. Chem. 10, 296 (2018); Nat. Chem. 9 33 (2017); Nat. Chem. 8, 657 (2016); Nat. Chem. 7, 105 (2015); Nat. Comm. 7, 10700 (2016); Nano Lett. 15, 2242–2248 (2015); Acc. Chem. Res. 48, 2140 (2015); Nature Nanotech. 7, 41 & 673 (2012).