Manipulating and characterizing matter at the atomic scale

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The scanning tunnelling microscope (STM) enables imaging of surfaces with atomic precision, the spectroscopy of electronic states and vibrational quanta with high energy resolution and the manipulation of matter at the single-atom and single-molecule level. Combining these opportunities in a single experiment is particularly appealing. This study will present two examples. The local injection of electrons into a single phthalocyanine molecule adsorbed on graphene-covered Ir(111) induces the abstraction of pyrrolic hydrogen. While the geometric configuration of the molecule stays invariant, its electronic structure changes considerably. The combination of STM data and density functional calculations unravels the entire depopulation of the highest occupied molecular orbital upon the single-molecule reaction. A new view on electron confinement at metal surfaces is provided by scanning tunnelling spectroscopy (STS) to top buried nano-cavities at Pb(111). Differential conductance data measured by STS show signatures of vertically confined quantum well states. Characteristic spectroscopic fine structure reveals additional quantization, which unexpectedly arises from quantum well reflection at the open boundary where the thin Pb film above the nano-cavity recovers its bulk thickness. Lateral confinement is thus achieved without confining potential.

Biography

Jörg Kröger has completed his PhD from Rheinisch-Westfälische Technische Hochschule Aachen (Germany). Since 2010, he has been holding a Chair in Experimental Physics at the Technical University of Ilmenau (Germany), where he is currently the Director of the Institute of Physics. He has published more than 100 papers in reputed journals and has been serving as an Editorial Board Member of Scanning and Journal of Nanoscience and Nanotechnology.

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