O 26: Nanostructures at surfaces: Dots, particles, clusters II (SPM)

Time: Tuesday 15:00–16:45 Location: SCH A215

O 26.1 Tue 15:00 SCH A215

Quantum well states in two-dimensional gold clusters — Xiao Lin[1], •Niklas Nilius[1], Hans-Joachim Freund[1], Michael Walter[2], Pentti Frondelius[2], Karolina Honkala[2], and Hannu Häkkinen[2] — [1]Fritz-Haber Institut der MPG, D14195 Berlin, Germany — [2]Department of Physics, University of Jyväskylä, FI-40014 Finland

The electronic structure of ultra-small Au clusters on thin MgO/Ag(001) films is analyzed by scanning tunneling spectroscopy and density functional theory. The clusters exhibit two-dimensional quantum well states, whose shapes resemble the eigenstates of a 2D electron gas confined in a parabolic potential. From the HOMO and LUMO symmetries, the electron filling and charge state of particular clusters are determined. In accordance to a DFT charge-analysis, the aggregates accumulate a number of excess electrons due to charge transfer from the support. Monitoring the HOMO-LUMO gap as a function of cluster size, the transition from non-metallic to metallic Au behavior is deduced for clusters containing 70-100 atoms.

O 26.2 Tue 15:15 SCH A215

Fluorescence Enhancement by Increase of Spontaneous Emission Rate between Two Metal Nanoparticles — •Phillip Olk[1], Thomas Härtling[1], Marc Tobias Wenzel[1], Petra Mela[2], Martin Möller[2], and Lukas M. Eng[1] — [1]Institut für angewandte Photophysik, TU Dresden, 01062 Dresden — [2]DWI an der RWTH Aachen e.V., 52056 Aachen

Small metal nanoparticles are known to be suitable for nano-optical experiments due to the enhanced electric fields in their very vicinity. We show here that coupling of very small gold particles of 12 nm in diameter to a 80 nm particle attached to a scanning fibre probe affects the fluorescence signal of a surrounding fluorescent immersion medium dramatically.

By comparison of our experimental result to calculations based on the multiple multipole method we exclude multiple causes for the increased fluorescence signal: locally enhanced fields of the excitation light, re-orientation of the fluorescent dipoles, enhanced scattering efficiencies, or an increase of the metal's auto-fluorescence can be ruled out. Instead, we ascribe the increased fluorescence signal to an influence of the nanoparticles on the *emission* behaviour of the dye.

O 26.3 Tue 15:30 SCH A215

Finite size effects in isolated superconducting clusters of Pb-An STM study — Ivan Brihuega[1], •Sangita Bose[1], Miguel Moreno Ugeda[1,2], Christian H. Michaelis[1], and Klaus Kern[1,3] — [1]Max-Planck-Institut für Festkörperforschung, Heisenbergstrasse 1, D-70569 Stuttgart,Germany — [2]Univ. Autonoma Madrid, Dept. Fis. Mat. Condensada, E-28049 Madrid, Spain. — [3]Institut de Physique des Nanostructures, Ecole Polytechnique Fédérale de Lausanne, CH-1015 Lausanne, Switzerland.

We report on the evolution of superconductivity in isolated Pb nanoparticles grown in situ probed by Scanning tunneling spectroscopy (STS). We observe a gradual decrease of the superconducting energy gap (D) with reduction in particle size which is accompanied by a simultaneous increase in the quasiparticle lifetime broadening (G). Superconductivity gets completely destroyed at small particle sizes which are consistent with the Anderson criterion. Our results also show that for these small particles the evolution of Tc is mainly governed by the quantum size effects (QSE).

O 26.4 Tue 15:45 SCH A215

Interaction of the STM tip with adatoms on metal surfaces: ab initio study — •Kun Tao[1], Valeri S Stepanyuk[1], and Patrick Bruno[2] — [1]Max-Planck Institute of Microstructure Physics, Weinberg 2, 06120 Halle, Germany — [2]European Synchrotron Radiation Facility BP 220, F-38043 Grenoble Cedex, France

Using first-principles calculations based on the density functional theory, we investigate interaction of the STM tip with magnetic adatoms on metal surfaces. We perform calculations in the fully relaxed geometries for the tip and the substrate. Both interactions with nonmagnetic and magnetic tips are studied. We concentrate on 3d transition metal adatoms supported on Cu(001) and Cu(111) surfaces. The exchange interaction of the magnetic tip with 3d transition metal adatoms supported on Cu(001) surface is discussed. Our results indicate that the spin direction of the magnetic adatoms can be manipulated by approaching the tip to the substrate. The interplay between the structure relaxations and the electronic properties of the junction is revealed.

O 26.5 Tue 16:00 SCH A215

Two level conductance fluctuations investigated with LT-STM — •Alexander Sperl, Jörg Kröger, and Richard Berndt — Christian-Albrechts-Universität zu Kiel, D-24098 Kiel, Germany

Single silver atoms adsorbed on a Ag(111) surface were contacted with the tip of a cryogenic scanning tunneling microscope. At small tip-atom distances we observe fluctuations of the junction conductance between two levels. These two-level fluctuations depend on the applied voltage between tip and sample. An analysis of this behavior will be presented. Funding by the Deutsche Forschungsgemeinschaft through SPP 1153 is acknowledged.

O 26.6 Tue 16:15 SCH A215

Linewidth of a Cesium Adatom Resonance on Ag(111) — •Martin Ziegler[1], Jörg Kröger[1], Richard Berndt[1], Andrei Borisov[2,3], and Jean-Pierre Gauyacq[2,3] — [1]Christian-Albrechts-Universität zu Kiel, D-24098 Kiel, Germany — [2]CNRS, Laboratoire des Collisions Atomiques et Moléculaires, UMR 8625 , Bâtiment 351, 91405 Orsay Cedex, France — [3]Université Paris-Sud, Laboratoire des Collisions Atomiques et Moléculaires, UMR 8625, Bâtiment 351, 91405 Orsay Cedex, France

Single Cs atoms adsorbed on Ag(111) induce a resonance appearing just below the threshold of the quasi-two-dimensional Shockley-type surface state continuum. Spectroscopic analysis using a cryogenic scanning tunneling microscope and theoretical modeling are used to identify the importance of the various contributions to the linewidth and to the decay of the resonance: resonant charge transfer, inelastic transitions, and adsorbate vibrations perpendicular to the surface. *Financial support by the Deutsche Forschungsgemeinschaft through SFB668 is acknowledged.*

O 26.7 Tue 16:30 SCH A215

Local electronic properties of individual nanostructures on the boron nitride nanomesh — •Christian H. Michaelis, Sangita Bose, Ivan Brihuega, and Klaus Kern — Max-Planck-Institut für Festkörperforschung, Heisenbergstraße 1, 70569 Stuttgart

We present the final development of a home-built sub-Kelvin STM which operates in ultra high vacuum conditions, is equipped with a 14 Tesla magnet and has a base temperature of 0.9 K. We have used this low temperature STM for the spectroscopic study of isolated nanostructures and molecules on top of a boron nitride ultrathin insulating spacer on Rh(111). This combination offers the unique possibility of investigating the local electronic properties of atomic-scale structures with ultimate energy resolution. As examples we will discuss magnetic and superconducting metal clusters and functional organic molecules.