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Unifying Concepts in Catalysis

UniCat Colloquium

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Lecturer: **Dr. Michael Walter**, Material research center and Institute of Physics, Albert-Ludwigs-University of Freiburg

Title: **Delocalized electrons in gold and gold alloy clusters: STM flowers and protected superatoms**

Abstract: Gold has fascinated mankind since ancient times. One of the reasons is its inertness against chemical reactions in bulk form. Gold in small quantities behaves quite different however: It can be very reactive and possesses interesting structural varieties due to the strong interplay of atomic d and s states (a relativistic effect). Nevertheless, in the chemically important region around Fermi energy, the electronic structure is dictated by s derived delocalized states as we will show in the example of two quite distinct examples:

The first case are ultrasmall Au clusters on thin MgO/Ag(001) films that have been analyzed by scanning tunneling spectroscopy and density functional theory. The clusters exhibit two-dimensional (2D) quantum well states, whose shapes resemble the eigenstates of a 2D electron gas confined in a parabolic potential. From the symmetries of the states even the charge state of the cluster can be determined directly. Recently we extended our study to pure and oxidized supported Pd_9-clusters. Charging is not an issue in these catalytic active species, but in STM similar effects as in gold can be observed.

The second case are ligand protected gold clusters. These species can be synthesized by wet chemistry in macroscopic quantities and that they are stable in different environments and temperature ranges – an important prerequisite for their future application in large scale technologies. The magic stability of these clusters is a result of delocalized electron shell closings: All experimentally characterized clusters are "superatoms". We show that the superatom rules found for pure ligand protected gold clusters apply equally well for mixed transition metal clusters and that their behavior can be understood by simple valence electron counting rules.

Date: **Wednesday, 11 November 2009**

Time: **5:15 pm - around 6:45 pm**

Location: **TU Berlin**
Institute of Chemistry, Building C
Straße des 17. Juni 115, 10623 Berlin
room C 243

Organiser: Prof. Dr. Ludger Wöste (FUB)

Coffee and tea will be served thirty minutes prior to the lecture start.
Guests are cordially invited to attend!

Prof. Dr. Matthias Driess, Chair of the Cluster of Excellence UniCat