Master Thesis Projects available at the Max-Planck-Institute for Solid State Research, Stuttgart Nanoscale Science Department

1. Exploring the Energy Landscape of a Molecule on Different Surfaces

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In general molecules can exist in different shapes, where each such isomer corresponds to a local minimum on the potential energy landscape of the molecule. However, if the molecule rest on top of a substrate, then the properties of the molecule can change due to the interactions between the atoms in the molecule with those that constitute the surface of the substrate. This applies in particular to the shape of the molecule. While STM and AFM methods can tell us a lot about the arrangement of the molecule on the surface, the precise shape is not always accessible. In order to determine this shape, we need to study the energy landscape of the molecule on the surface and compare it with those configurations we find for the molecule in the gas phase far away from the substrate.
The topic of the proposed MS thesis consists of performing such an exploration of the energy landscape of some molecule of interest on one or more surfaces. For the exploration, our own G42-code will be employed, using appropriate empirical and/or ab initio energy functions. If possible, the structures found will be compared with data drawn from experiments that are being performed by members of the Kern research department.

2. Development of a Molecular Ion Beam Deposition Source

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Electrospray ion beam deposition combines the world of biological molecules with the precision of high resolution scanning tunneling microscopy. A commercial mass spectrometer serves as the basis for modification and testing of a mobile ion beam deposition apparatus. A student will be introduced into electrospray mass spectrometry and scanning probe microscopy. Main tasks are the design and simulation of the ion optics as well as the deposition of protein and peptide ions as demonstration of the working source.This project allows insight in a large variety of topics ranging from high performance biological mass spectrometry, over ion beam technology, to surface physics and chemistry.