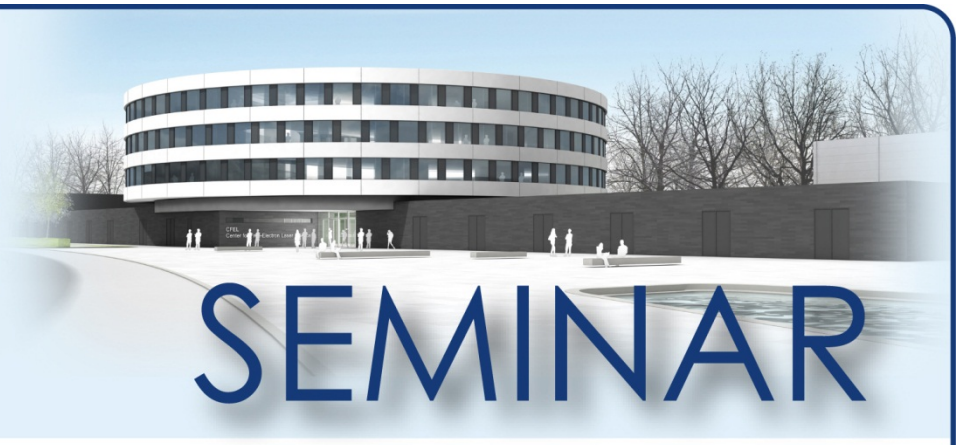
CFEL SCIENCE



SEMINAR

5th January 2012 - 11:00
Building 49 - Seminar Room 108

Shichao Yan

State Key Laboratory for Surface Physics, Institute of Physics,
Chinese Academy of Sciences, Beijing, China

Dynamics of a single molecule rotor controlled by molecular charge states

Observing and controlling rotational motion of a single molecule is critical for the development of nanoscale machines. Although rotational motion of various molecules on surfaces has been observed, it still remains a great challenge to control the rotational direction, speed, and on/off status. By combining low temperature scanning tunneling microscopy (STM) studies and density functional theory (DFT) calculations, we investigated the impact of molecular charge states on rotational motion of individual magnesium porphine (MgP) molecules on a NaCl bilayer. MgP molecules in two different charge states are distinguished as 4-lobe and 8-lobe configurations in STM images, and such two states can be reversibly switched upon the presence of tunneling electrons. The rotational motion of a single MgP molecule can be turned on and off by switching the molecular charge state, and the observed rotational dynamics in response to molecular charge states are revealed by DFT calculations. In addition, the rotational rate in charged MgP molecules is sensitive to the STM sample bias and the magnitude of tunneling current. Our studies demonstrate a new way to control the rotational behavior of a single molecule via its charge state, which is of great potential in designing novel electric controlled molecular rotors and motors.

Host: Sebastian Loth, MPSD CFEL