TECHNISCHE UNIVERSITÄT CHEMNITZ

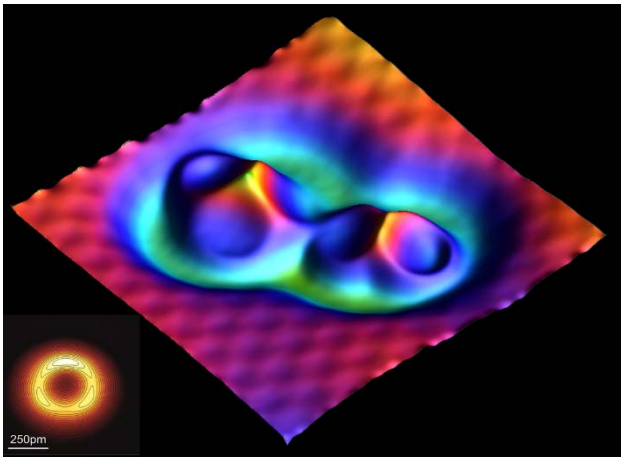
Institut für Physik
Physikalisches Kolloquium

Mittwoch, 11.07.2018, um **16:00 Uhr**
Ort: Reichenhainer Str. 90;
Zentrales Hörsaal- und Seminargebäude,
Raum 2/N013

Prof. Dr. Franz J. Giessibl
University of Regensburg

High resolution atomic force microscopy

The scanning tunneling microscope (STM), invented in 1981 at IBM Rüschlikon by Gerd Binnig and Heinrich Rohrer, has opened a new era of small things. STM relies on vacuum tunneling with an exponential increase of a tunneling current between two biased conductive electrodes at a factor of ten per Å (100 pm). If a tip has one atom that sticks out one Å more than all the others, this front atom carries ten times more current than the other atoms. The monotonic decrease of current with distance facilitates distance feedback and allows to scan the tip across a sample with atomic precision. In 1986, Binnig, Gerber and Quate introduced atomic force microscopy (AFM), a method that also images insulators by relying on forces. Unlike the current, the force between tip and sample is non-monotonic and includes long- and short range components. AFM has been inferior in resolution to STM for a long time. Today, AFM exceeds STM in spatial resolution by utilizing Pauli repulsion forces that change even stronger with distance than the tunneling current. That progress was enabled by advances in measuring small forces and by the isolation of chemical bonding forces from strong background forces. The special challenges of AFM lead to the invention of the qPlus sensor, a quartz force sensor that measures force gradients by frequency changes and was initially based on tuning forks used in Swatch wristwatches.



Using the outstanding precision of frequency measurements, we can today, measure the forces that act in atomic manipulation, measure exchange interactions with sub-pN sensitivity, image clusters and molecules with atomic resolution and single adatoms with subatomic resolution. While highest precision measurements require vacuum and low temperatures, we now use the qPlus sensor to explore phenomena at the atomic scale in ambient environments

AFM image of a Fe trimer next to a Fe dimer on Cu(111). Inset: AFM image of a single Fe atom on Cu(111) [M. Emmrich et al., *Science* **348** 308 (2015)].

Alle Zuhörer sind ab 15:45 zu Kaffee und Tee vor dem Hörsaal eingeladen.

Informationen zum Vortrag erteilt:
Prof. Dr. Ulrich T. Schwarz, Tel. 0371 531 30001

www.tu-chemnitz.de/physik