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S E M I N A R
aus
Halbleiterphysik und Nanotechnologie

Di, 6.12.2016, 11:00 Uhr, Hörsaal für Physik

"TERS: Imaging at the nanoscale with atomic force microscopy and Raman spectroscopy"

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From telescopes and microscopes, to parabolic mirrors supposedly used by Archimedes to set Roman ships on fire, all these optical elements, or any other optical element for that matter, have limitations on how good light can be focused. This was illustrated in the 19th century by Ernst Abbe giving way to the mathematical relation that bears his name: the Abbe diffraction limit. This is a fundamental physical limitation that stop us from seeing nanoscale objects with optical imaging and spectroscopy. The rise of plasmonics made possible to localize and amplify the electromagnetic field around molecules in contact with plasmonic nanoparticles. This allowed the ultimate sensitivity in Raman spectroscopy to be achieved: that of a single molecule, using surface-enhanced Raman spectroscopy (SERS). It turns out that we can achieve the ultimate SERS experiment in an atomic force microscope (AFM) using a single plasmonic nanoparticle in the form of an AFM tip. From the year 2000, this combination of Raman spectroscopy with AFM gave rise to a disruptive technology in nanoscale analysis known as tip-enhanced Raman spectroscopy (TERS). With TERS we benefit from the careful nanometric precision control of the plasmonic nanoparticle position thanks to AFM. The intense electric field confinement of Raman excitation and scattered signals makes possible the imaging of nano-objects with a spatial resolution way better of what the diffraction limit of light allows. During this seminar we will discuss on the principles behind TERS and give a general overview of the state of the art of this young but powerful technique. I will close by discussing concrete examples of what TERS is capable of from the research I am leading in this field since 2011 at the Semiconductor Physics group in TU Chemnitz, Germany.