



## Master's thesis opportunity for Master in Physics students

### “Super-resolution Raman microscopy based on tip-enhanced Raman spectroscopy (TERS)”

#### Background and project task

Recent developments have made possible to obtain optical resolution well below the diffraction limit using fluorescence-based optical microscopy. The inventors of these revolutionary imaging techniques were awarded with the Nobel Prize in Chemistry in 2014.

It is also possible to obtain optical images with lateral resolution below the diffraction limit of light by illuminating a gold tip of a cantilever using an AFM microscope combined with a Raman spectroscopy system. This method is referred to as tip-enhanced Raman spectroscopy (TERS) and can achieve very high signal-to-noise enhancements of several orders of magnitude and spatial resolution below 100 nm, due to the strong near-field focusing of light at the gold tip. Raman spectroscopy gives chemical information about the composition of the surface and can be performed without contrast enhancing additives, making this technique a very powerful means for high-resolution, spatial characterization of surfaces.

However, reproducible preparation of the special tips is a challenge, and also the long-term stability of the tips is not always guaranteed. The aims of the master's project is to establish the TERS method on a high-end Raman microscope available at Uni Ulm, and to evaluate the underlying reasons for potential long-term instabilities and reproducibility issues. The project will be carried out as a collaboration between two Institutes of the Ulm University, Institute of Experimental Physics and Institute Inorganic Chemistry II, and two nanotechnology companies.

#### Who should apply?

We are looking for master candidates having Physics as their main subject.

**Dead-line for application: 21.2.2014**

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