At the tip of the wand:
Obtaining topographic and chemical information from interfaces

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A tip-substrate cavity as present in scanning probe microscopy (SPM) experiments can be considered as a quite simple, but effective photonic unit with a tunable plasmon resonance providing huge enhancements for optical processes. Such an enhancing unit lies at the basis of tip-enhanced Raman spectroscopy (TERS), a combination of SPM and Raman spectroscopy: By focussing a laser onto the very end of the SPM tip apex, localized surface plasmons (LSPs), or gap modes, are excited, which create a very strong near-field between tip and metal sample, a 'hot spot'. Only the molecules located in this hot spot contribute to the strong Raman signal. In this way, the usually very low normal Raman scattering cross section is overcome and vibrational analyses of a small amount of species, like an adsorbate monolayer, can be carried out. In addition to the Raman chemical fingerprint of the target species, the topography of the sample can be obtained simultaneously with SPM.

In my talk, I will discuss the advantages and disadvantages of different experimental TERS approaches and present an overview about the application of TERS to a variety of samples reaching from single dye molecules to species of biological, catalytic or technological interest, like DNA nucleobases, porphyrins, or SiC.