Dynamics of electronic surface excitations and their manipulation probed by 2PPE techniques

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The lifetime of electronic surface excitations such as adsorbate resonances can be of vital importance for surface chemical reactions. The capability of tuning this parameter potentially enables, therefore, to manipulate e.g. the efficiency or the selectivity of such a process. As the lifetime of a surface excitation is essentially determined by the electronic coupling to the substrate, a manipulative access to the substrate's electronic structure is one possible approach to achieve this goal. One example are quantum wells where the energy and number of the discrete bound electron states depend critically on the width of the quantum well. Using time-resolved two-photon photoelectron spectroscopy, we can show that the lifetime of an adsorbate excitation in interaction with such a quantum well is significantly affected by the width of the quantum well.

In the second part of my talk I will focus on the dynamics of collective electronic excitations at nanostructured surfaces. We use photoemission electron microscopy in combination with phase-resolved two photon photoemission to address specific properties of localized surface plasmons (LSP) in silver nanoparticles. This technique enables to map the femtosecond dynamics of these excitations at a nanometer resolution. I will present some first results where we monitor variations in the local field distribution associated with a LSP as function of the phase between the pump and the probe pulse.