Markus Betz

markus.betz@tu-dortmund.de

Experimentelle Physik 2,
TU Dortmund, Germany

Active Plasmonics with Surface Acoustic Waves

In my talk, I will discuss the impact of coherent surface acoustic waves (SAWs) on plasmonic devices. These high-frequency mechanical distortions can be driven all-electrically using conventional radio-frequency electronics. In a first step, we demonstrate a SAW driven converter of light into surface plasmon polaritons. In essence, an otherwise unstructured metal thin film is deformed by surface-bound acoustic waves traveling on a piezoelectric substrate underneath. This spatially periodic corrugation enables to overcome the wavevector mismatch between free-space radiation and surface-bound electro-magnetic modes. This concept is demonstrated for gold thin films on a $LiNbO_3$ chip. In particular, interdigital transducers generate ~500 MHz surface acoustic waves of ~1 nm surface ripple on the substrate and the deposited metal film. For near-infrared light of 950 nm wavelength we observe a 0.01%%efficiency for the excitation of surface plasmon polaritons. As a next step, we explore the influence of radio-frequency SAWs travelling across a commensurable, static gold grating. Such a structure constitutes a paradigm for a pre-defined injector for surface plasmon polaritons. Here, the electro-mechanically induced, dynamic surface deformation strongly modulates the launcher's coupling characteristics on sub-nanosecond timescales. The modulation of the efficiency is as large as 2%%and is monitored in real time with a stroboscopic technique utilizing SAWs synchronized to an optical pulse train.