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Abstract

Near-Field THz Nanoscopy with Novel Accelerator-Based Photon Sources †

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This talk advertises scattering-type scanning near-field infrared/THz nanospectroscopy (s-SNIM) in the spectral range of 75 to 1.2 THz [1,2], as provided by the free-electron laser FELBE at the Helmholtz-Zentrum Dresden-Rossendorf (HZDR), Germany. By combining s-SNIM with FELBE, we demonstrate a λ-independent optical resolution of ~10 nm only, by exploring structured Au samples, Graphene-nanotransistors, meta-materials [3,4], and local-scale ferroic phase-transitions [5–7] down to LHe temperatures [8]. Moreover, also the non-linear optical responses at IR wavelengths can be explored, as recently demonstrated when inspecting highly-doped GaAs/InGaAs core/shell nanowires [9]. Our THz-s-SNIM was also integrated into a THz pump-probe setup for the local analysis of excited states in structured SiGe samples. We developed a sophisticated demodulation technique that extracts pump-induced signals with a superior signal-to-noise ratio [10]. In addition, HZDR recently extended the available wavelength ranges down to the 100 GHz radiation, employing the novel super-radiant TELBE light source [11,12]. We adapted our s-SNIM to that novel TELBE photon source as well, achieving an equally high spatial resolution as with FELBE. This now allows to bridge the famous THz-gap in order to explore novel quantum phenomena of magnons, spin waves, and phonon polaritons in a various 2D and 3D materials.

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