Colloquium

Atomic-scale spectroscopy: from magnetic adatoms on superconductors to coherent phonons on semiconductors

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In addition to being an ideal tool for imaging and manipulating atoms and molecules on surfaces, the potential of the scanning tunneling microscope (STM) for high-resolution spectroscopy has been recognized in the fields of single-molecule physics, magnetism, and superconductivity. Recently, optical and terahertz pulses coupled into the STM junction have added ultrafast time resolution to this versatile experimental technique. Here, we use the STM to resolve the interplay of magnetic atoms with superconducting substrates. The magnetic adsorbates induce bound states - known as Yu-Shiba-Rusinov (YSR) states - within the superconducting energy gap. These states remain isolated from the bulk, and, thus, provide a wide range of possibilities for engineering hybridized states, band formation, and topology. In a very different experiment we add time resolution to our STM experiments. To do so, we couple THz pulses into the STM junction and then record the time-delayed response of the junction conductance. We apply this pump-probe scheme to investigate the role of defects on phonon properties of the indirect bandgap semiconductor 2H-MoTe2. We identify two coherent phonons modes in the Fourier transform of the time-delay spectra. In the vicinity of defects, the relative intensity of the phonon modes changes. We ascribe this change to modified band bending near the defects, which changes the coupling efficiency to the THz pulses

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Office Bldg West / Ground floor / Heinzel Seminar Room (I21.EG.101)

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