

Optical near-field spectroscopy of layered materials

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Abstract

We use near-field microscopy to study layered materials with an optical resolution beyond the diffraction limit. These techniques are based on elastic and inelastic light scattering at an atomic force microscope tip. In a first study, we focus on elastically scattered light using s-SNOM and nano-FTIR allowing us to map the local carrier density of TEA-intercalated MoS₂. In a second study, we utilize inelastically scattered light, specifically tip-enhanced photoluminescence, to investigate color centers in metalorganic vapor phase epitaxy-grown hexagonal boron nitride (hBN). We demonstrate direct near-field optical excitation and emission through interaction with the nanofocus of the tip resulting in a sub-diffraction limited TEPL hotspot. In addition, we observe tip-assisted PL due to the interference between direct beams to/from the color center and those scattered from the AFM tip.