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Direct observation and simulations of atomically resolved low loss images in graphene MYRON KAPETANAKIS, MARK OXLEY, JUAN-CARLOS IDROBO, Vanderbilt University & Oak Ridge National Laboratory, WU ZHOU, STEPHEN PENNYCOOK, Oak Ridge National Laboratory, SOKRATES PANTELIDES, Vanderbilt University & Oak Ridge National Laboratory — Aberration-corrected scanning transmission electron microscopy (STEM) at low voltages provides atomic-resolution imaging of many two-dimensional materials, such as pristine graphene, using core-loss and low-loss spectra. Traditionally, EELS-STEM imaging and density functional theory (DFT) simulations were carried out by two different communities with minimal overlap. One community includes diffraction but ignores solid-state effects in the spectra, while the other includes solid-state effects but leaves out diffraction and interference. Recent work has combined DFT calculations and dynamical scattering to allow the simulation of probe position dependent core-loss spectra. In this talk we describe extension of this work to calculations of STEM images based on low-loss spectroscopy. It is usually assumed that such signals are highly delocalized, since plasmons represent a collective excitation. Considering that not all low-loss excitations are plasmonic in nature, we examine the role of interband transitions in the formation of atomic resolution low-loss images. We compare experimental results that show atomic resolution lattice images of graphene based on low-loss signals with simulations of images based on low-loss scattering potentials.

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