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High Resolution Single Molecule Vibrational Spectroscopy with the STM CHEN XU, CHILUN JIANG, YANNING ZHANG, RUQIAN WU, WILSON HO, Department of Physics and Astronomy, University of California, Irvine — Inelastic electron tunneling spectroscopy (IETS) with the scanning tunneling microscope (STM) has been regarded as the ultimate tool to identify and characterize single molecules adsorbed on solid surfaces with atomic spatial resolution. With the improvement of energy resolution obtained at ~ 600 mK, STM-IETS is able to resolve the lowest vibrational energies and reveal subtle interactions between the molecule and its environment which were previously not possible at higher temperatures. Here we demonstrate the capability of sub-Kelvin STM on detecting the influence of the tip as well as the anisotropy of the reconstructed Au(110) surface on the low energy hindered vibrational motions of single adsorbed CO molecule. Single molecule vibrational spectroscopy at ~ 600 mK with atomic scale spatial resolution opens new possibilities to probe molecular interactions with high spectral sub-THz resolution.

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