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Probing the Hydrogen Bond Strength at Single Bond Limit[1] JING GUO, International Center for Quantum Materials, School of Physics, Peking University, JING-TAO LÜ, School of Physics, Huazhong University of Science and Technology, JI CHEN, JINBO PENG, XIANGZHI MENG, ZHICHANG WANG, International Center for Quantum Materials, School of Physics, Peking University, XIN-ZHENG LI, School of Physics, Peking University; Collaborative Innovation Center of Quantum Matter, Beijing, ENGE WANG, YING JIANG, International Center for Quantum Materials, School of Physics, Peking University; Collaborative Innovation Center of Quantum Matter, Beijing — Many extraordinary physical, chemical and biological properties of water are determined by hydrogen-bonding interaction between the water molecules. So far, the routine way to determine the hydrogen-bonding strength of water is probing the frequency shift of O-H stretching mode using various spectroscopic techniques, which all suffer from the difficulty of spectral assignment and the broadening of vibrational signals due to the lack of spatial resolution. In this talk, we show the ability to probe the hydrogen-bonding strength of interfacial water at single bond limit using resonantly enhanced inelastic electron tunneling spectroscopy (IETS) with a scanning tunneling microscope (STM). The conventional IET signals of water molecules are extremely weak and far beyond the experimental detection limit due to the negligible molecular density of states (DOS) around the Fermi level. This difficulty can be surmounted by turning on the tip-water coupling, which shifts and broadens the frontier molecular orbitals of water to the proximity of Fermi level, resulting in a resonantly enhanced IET process.

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