The 898th IMS colloquium

Probing quantum nature of interfacial water at atomic scale



Prof. Ying Jiang

Associate Professor International Center for Quantum Materials, Peking University Date & Time: 2017/1/23 (Mon.) 16:00-Place: IMS Research Building Room 201

Quantum behaviors of protons in terms of tunneling and zero-point motion have significant effects on water properties, structure, and dynamics even at room and at higher temperature. In spite of tremendous theoretical and experimental efforts, accurate and quantitative description of the nuclear quantum effects (NQEs) in water is still challenging. The main difficulty lies in that the quantum states of protons are extremely susceptible to the structural inhomogeneity and local environments, especially when interfacial systems are concerned. Using a combined scanning tunneling microscope (STM) and noncontact atomic force microscope (NC-AFM) system, we are able to achieve submolecular-resolution imaging [1,2] and single-bond vibrational spectroscopy [3] of water molecules on a NaCl(001) surface via functionalized tips, which allow us to access the quantum degree of freedom of protons both in real space and energy space. I will discuss how those techniques are used to address some important issues of NQEs such as concerted proton tunneling [4] and anharmonic quantum fluctuation [3]. Those findings may renovate our understanding of water and provide answers to many weirdness of water from a quantum mechanical view.

- 1. J. Guo, Y. Jiang* et al., *Nature Materials* 13, 184 (2014).
- 2. J. Chen, Y. Jiang* et al., Nature Communications 5, 4056 (2014).
- 3. J. Guo, Y. Jiang^{*} et al., *Science* 352, 321 (2016).
- 4. X. Meng, Y. Jiang* et al., Nature Physics 11, 235 (2015).