

Probing interfacial water and hydration at submolecular level

Ying Jiang

*International Center for Quantum Materials, School of Physics, Peking University, Beijing 100871,
P. R. China*
yjiang@pku.edu.cn

Interfacial water is ubiquitous in nature and plays an essential role in a broad spectrum of physics, chemistry, biology, energy and material sciences. One of the most fundamental issues is the characterization of H-bonding structure and dynamics on surfaces. Ideally, attacking this problem requires the access to the internal degrees of freedom of water molecules, i.e. the directionality of OH bonds. However, it remains a great challenge due to the small size of hydrogen. In this talk, I will present our recent progress on the development of new-generation scanning probe microscopy/spectroscopy with ultrahigh sensitivity and resolution, and its application to interfacial water and ion hydration. I will focus on how to achieve submolecular-resolution imaging [1,2] and single-bond vibrational spectroscopy [3] of water molecules and clusters via controlling tip-water coupling. Those technical advances provide us unprecedented opportunity to identify the topology of H-bonding networks [4], track the proton tunneling [5], unravel the quantum nature of H bond [3], and reveal the effect of hydration number on the ion transport [6].

References:

- [1] J. Guo, X. Z. Meng, J. Chen, J. B. Peng, J. M. Sheng, X. Z. Li, L. M. Xu, J. R. Shi, E. G. Wang*, Y. Jiang*, *Nature Materials* **13**, 184 (2014).
- [2] J. Peng, J. Guo, P. Hapala, D. Cao, R. Ma, B. Cheng, L. Xu, M. Ondráček, P. Jelínek*, E. G. Wang*, and Y. Jiang*, *Nature Communications* **9**, 122 (2018).
- [3] J. Guo, J.-T. Lü, Y. Feng, J. Chen, J. Peng, Z. Lin, X. Meng, Z. Wang, X.-Z. Li*, E.-G. Wang* and Y. Jiang*, *Science* **352**, 321 (2016).
- [4] J. Chen, J. Guo, X. Z. Meng, J. B. Peng, J. M. Sheng, L. M. Xu, Y. Jiang*, X. Z. Li*, E. G. Wang, *Nature Communications* **5**, 4056 (2014).
- [5] X. Meng, J. Guo, J. Peng, J. Chen, Z. Wang, J. R. Shi, X. Z. Li, E. G. Wang*, Y. Jiang*, *Nature Physics*, **11**, 235 (2015).
- [6] J. Peng, D. Cao, Z. He, J. Guo, P. Hapala, R. Ma, B. Cheng, J. Chen, W.-J. Xie, X.-Z. Li, P. Jelínek, L.-M. Xu*, Y.-Q. Gao*, E.-G. Wang*, Y. Jiang*, *Nature*, accepted (2018)