Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Observation of Franck-Condon Blockade in Single Molecules Gated by Local Electric Field AIDI ZHAO, CHUNSHENG ZHOU, WEIYI WANG, Hefei National Laboratory for Physical Sciences at Microscale, University of Science and Technology of China, GUANGJUN TIAN, Division of Theoretical Chemistry & Biology, KTH Royal Institute of Technology, HUAN SHAN, SHULAI LEI, YINGBO ZHAO, YI LUO, QUNXIANG LI, BING WANG, J.G. HOU, Hefei National Laboratory for Physical Sciences at Microscale, University of Science and Technology of China — Electron transport through single molecules is greatly influenced by a discrete spectrum of vibrational modes in strong electron-vibron coupling regime. Theory predicts a current suppression at low biases known as Franck-Condon blockade. However, how Franck-Condon blockade emerges in in a real orbital-gated single molecule transistor is still elusive. In this study, by using a low-temperature scanning tunneling microscope, we report the real-space observation of Franck-Condon blockade in single molecules adsorbed on metal surfaces. The frontier molecular orbitals and charge state of the molecules are shown to be electrostatically gated by variation in the underlying surface potential and local chemical environment, allowing the observation of coulomb blockade as well as the Franck-Condon blockade. Moreover, strongly enhanced inelastic cotunneling is evidenced to dominate the electron transport in the Franck-Condon blockade regime, leading to unprecedented high-contrast single molecule vibrational spectroscopy and microscopy.

Aidi Zhao
Univ of Sci & Tech of China

Date submitted: 11 Nov 2014 Electronic form version 1.4