Understanding and Controlling Topological Quantum States on Surfaces

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Abstract: Topological quantum materials host symmetry-protected electronic states that offer promising routes toward robust and exotic quantum functionalities. In this talk, I will show how scanning tunneling microscopy and spectroscopy (STM/S) enable direct atomic-scale visualization and manipulation of these states. I will present spectroscopic signatures of topological surface states, demonstrate how magnetism can open an exchange gap in topological insulators, and discuss efforts to realize and identify Majorana zero modes in topological superconductors. I will also highlight how atomic manipulation can be used to create artificial lattices for exploring designer quantum states. These studies illustrate the manifestation of band topology on material surfaces and the utilization of STM for probing and controlling topological quantum matter.

Bio: An-Ping Li is a Distinguished Research Staff at the Center for Nanophase Materials Sciences (CNMS) at Oak Ridge National Laboratory (ORNL), where he leads the Scanning Tunneling Microscopy (STM) Group and the Heterogeneities in Quantum Materials (HQM) research theme. His research focuses on probing and controlling quantum materials at the atomic scale using advanced scanning tunneling microscopy techniques. He is a Fellow of the American Physical Society (APS) and the American Vacuum Society (AVS).