Local Electronic States and Magnetic Response of Topological Magnets by Scanning Tunneling Microscopy and Spectroscopy

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Scanning tunneling microscopy & spectroscopy (STM/S) plays a key role in topological matter study, especially has been employed to directly visualize the topological edge states. Magnetic topological insulators (MTI's) are narrow band gap semiconductor materials that combine non-trivial band topology and magnetic order. Particular attention has been paid to find suitable MTI's platform for decisive realization of the quantum anomalous Hall effect (QAHE). $MnBi_2Te_4$ is a recently discovered antiferromagnetic topological insulator, which is composed of an alternatively stacked magnetic layer ($MnTe_2$) and nonmagnetic layer (Bi_2Te_3). Information about the magnetic and topological properties of these systems comes, so far, largely from macroscopic techniques, with little being known about the microscopic atomic scale properties. Here, we employ low-temperature scanning tunneling microscopy to study the electronic properties of Mn based ternary intrinsic MTI's single crystal bulk surface as well as their odd and even layers. The spatial dependent scanning tunneling spectroscopy clearly indicates the existence of edge states at a step edge of a magnetic $MnBi_2Te_4$ layer but absent at nonmagnetic Bi_2Te_3 layers up to the temperature above Neel temperature of anti-ferromagnetic states.