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Probing interface reconstructions in multiferroic $BiFeO_3$ and charge ordered $La_{0.5}Ca_{0.5}MnO_3$ heterostructures GUNEETA SINGH-BHALLA, MORGAN TRASSIN, YING-HAO CHU, RAMMAMOORTHY RAMESH, Berkeley — Spurred by the potential for device structures with multiple tuning parameters, recent explorations of carefully engineered oxide interfaces have highlighted intriguing possibilities. A famous example includes the $LaAlO_3/SrTiO_3$ heterostructure where the individual layers are insulating but an electron gas appears at the interface. In similar fashion, the atomically engineered interface between antiferromagnetic $BiFeO_3$ and ferromagnetic manganite [La,Sr]MnO_3 results in the formation of a ferromagnetic state in $BiFeO_3$ at the interface. Here we explore the interface between $BiFeO_3$ and the charge ordered manganite, $La_{0.5}Ca_{0.5}MnO_3$. The insulating nature of $La_{0.5}Ca_{0.5}MnO_3$ and $BiFeO_3$ allows us to directly probe the electronic properties of the interface via transport measurements. A combination of capacitance and field effect measurements combined with structural probes shed new light on the charge ordered manganite and multiferroic interface. We explore the effects of cross-plane ferroelectric switching in $BiFeO_3$ on charge ordering in $La_{0.5}Ca_{0.5}MnO_3$, and hence the electronic and magnetic properties of $La_{0.5}Ca_{0.5}MnO_3$ near the interface. We discuss our results and implications.

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