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Reversible Electric Control of Exchange Bias in an Oxide Based Multiferroic Field Effect Device[1] STEPHEN WU, SHANE CYBART, PU YU, R. RAMESH, R.C. DYNES, Materials Sciences Division, Lawrence Berkeley National Laboratory — We report the fabrication and measurement of multiferroic/ferromagnet, $BiFeO_3$(BFO) / $La_{0.7}Sr_{0.3}MnO_3$(LSMO), electric field effect devices. The antiferromagnetic (AFM) ordering of the BFO dielectric layer is coupled to the ferromagnetic (FM) ordering of the LSMO channel layer and is observed as exchange bias –a shift of the LSMO magnetic hysteresis curve along the applied field axis. Because BFO has coupled AFM and FE order parameters, it acts as an electrically controllable AFM pinning layer. This allows for the electric control of the FM properties of LSMO. By switching the FE polarization of BFO we observe a change in conductivity in the channel of over 100%, and a 71% change in magnetic coercivity at 5.5 K. Furthermore, we can reversibly switch between two distinct exchange bias states corresponding to the different FE polarizations. The difference in exchange bias between the two states is approximately 20mT.

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