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Magnetoelectric coupling across the BiFeO3/manganite interface

DI YI, JIAN LIU, UC berkeley, PU YU, Physics Department, Tsinghua University, WEIDONG LUO, Materials Science and Technology Division, Oak Ridge National Laboratory, SURESHA JAGANATHA, National Center for Electron Microscopy, LBNL, GUNEETA BHALLA, UC berkeley, GUNNAR PALSSON, ELKE ARENHOLZ, Advanced Light Source, LBNL, SATOSHI OKAMOTO, Materials Science and Technology Division, Oak Ridge National Laboratory, RAMAMOORTHY RAMESH, UC Berkeley — Artificially constructed heterointerfaces between strongly correlated systems provide researchers an extensive playground to investigate the novel physics and fascinating states. Recently it has been shown that an exotic magnetoelectric coupling exists at the ferromagnetic manganite La0.7Sr0.3MnO3 (LSMO) and the multiferroic BiFeO3 (BFO) interface, in which the magnetization, the coercive field and exchange bias of LSMO can be controlled by the ferroelectric polarization of BFO. First principle calculations illustrate that different charge screening of polarization lead to different coupling mechanism. To further explore the magnetoelectric coupling, we also investigate the heterostructure between BiFeO3 and half-doped manganite La0.5Ca0.5MnO3 (LCMO). Unlike LSMO which is a ferromagnetic metal, LCMO thin film exhibits a paramagnetic semiconducting behavior in the temperature range we studied, yet the magnetization of LCMO in an applied magnetic field enhanced by a factor of 2 by switching the ferroelectric polarization. X-ray absorption data reveals the different valence states of Mn, consistent with the charge screening model.

Di Yi
UC berkeley

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