Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Tunable Orbital-Selective Magnetic Interaction in Tricolor Oxide Interfaces YANWEI CAO, MICHAEL KAREEV, XIAORAN LIU, DEBRAJ CHOUDHURY, SRIMANTA MIDDEY, DEREK MEYERS, JAK CHAKHALIAN, University of Arkansas — Recently, several theoretical scenarios of orbital-selective magnetic interactions were proposed to understand the emergence of the unexpected interfacial magnetism in the archetypical $SrTiO_3$-based two-dimensional electron gas systems, the origin of which is still intriguing and not an entirely understood phenomenon in oxide interface physics. Experimentally, however, there thus far lacks a material system to directly demonstrate the magnetic interaction with orbital-selection (dxy vs. dxz/dyz) and eventually manipulate this magnetic interaction. To address this, here we induced 2DEG and localized magnetism into the same $SrTiO_3$ layer by devising the heterostructure $LaTiO_3/SrTiO_3/YTiO_3$. Combined electrical transport and atomic-resolved scanning transmission electron microscope with electron energy loss spectroscopy revealed that the magnetic localized electrons are formed by the spin transfer from the YTiO3 layer into 2DEG formed at the $LaTiO_3$ /$SrTiO_3$ interface, with the orbital occupancy and strength of the magnetic interaction controlled by the $SrTiO_3$ layer thickness. Our work provides an ideal platform to explore the orbital physics driven by the interfacial magnetism with prospects for exciting spintronic applications.

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Date submitted: 13 Nov 2014 Electronic form version 1.4