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Emergent Magnetic Phenomena at Oxide Interfaces[1]

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Interfaces of transition metal oxides have attracted considerable attention for both fundamentally new physics and novel functionalities. Magnetic properties at oxide interfaces can be significantly different to the bulk constituents, because the delicate balance among competing terms can be broken by many mechanisms, including proximity effect, interfacial defects, strain, broken translational symmetry and charge transfer *etc.* Both instances of suppressed magnetization and emergent magnetization have been observed, which can have significant consequence on the macroscopic properties of oxide heterostructures [1]. For example, we have found that the emergent nanoscale magnetization can give rise to the spin filter effect in magnetic tunnel junctions consisting of ferromagnetic manganite and insulating cuprate, which affects the spin dependent charge transport in oxide heterostructures and thus provides a knob for engineering oxide spintronics. We have also observed that the interfacial magnetization of a ferromagnetic manganite layer greatly depends on the thickness of the capping layers, which is apparently related to the induced interfacial oxygen vacancies. This result highlights the role of defect engineering in optimizing functional oxides, which is a key theme of the advanced semiconductor technology. At last, we will show that, with an adjacent oxygen-ion-conductor layer, interfacial oxygen vacancies of a transition metal oxide can be controlled via solid state gating, paving a path toward nonvolatile electric control on interfacial magnetism. [1] Y. Liu and X. Ke, Interfacial magnetism in complex oxide heterostructures probed by neutrons and x-rays. J. Phys. Condens. Matter, 27, 373003 (2015).

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