Magnetic Effects at Perovskite Interfaces

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Perovskite materials (crystalline ABO_3 compounds) exhibit a broad range of properties of great scientific interest and technological importance, including magnetism, superconductivity, ferroelectricity, ionic conductivity, and catalytic activity, all in one single class of oxides. Epitaxial films and multilayers – i.e. artificial monolithic structures containing different perovskites – are an ideal platform to study the effects of mechanical strain and electronic interfacial coupling between these complex materials. Such superlattices and heterostructures can be obtained by pulsed-laser deposition (PLD) with great control and flexibility.

Electronic reconstruction has been observed by various groups at interfaces between dissimilar insulating perovskites, e.g. $SrTiO_3/LaAlO_3$ or $SrTiO_3/LaTiO_3$, leading to superconductivity or magnetism at the interface. Here we show that a strong interfacial magnetization is induced by electronic effects at the interface between the antiferromagnetic charge-transfer insulator $LaMnO_3$ and the band insulator $SrTiO_3$. The magnetic properties depend strongly on the atomic structure of the interface.

This presentation will also describe results of superlattices comprised of ferromagnetic (e.g. $(La,Sr)MnO_3$) and antiferromagnetic (e.g. $(La,Sr)FeO_3$) materials, where exchange coupling at the interfaces strongly influences the macroscopic behavior. In addition, we show that the ferromagnetic and antiferromagnetic order parameters exhibit a different dependence on the sublayer thickness in such superlattices.

The talk will therefore illustrate how superlattice materials can exhibit properties that are different from the constituents and different from their alloys.

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