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Unexpected magnetic Exchange Interaction between Epitaxial $La_{0.67}Sr_{0.33}MnO_3$ film and a two Dimensional Electron Gas at an $LaAlO_3/SrTiO_3$ Interface[1] W.M. LU, X. WANG, Z.Q. LIU, K. GOPINADHAN, A. ANNADI, S.W. ZENG, Z. HUANG, S. DHAR, - ARIANDO, T. VENKATESAN, NUSNNI-Nanocore, University of Singapore, Singapore — We have examined the electrical and magnetic properties of LSMO films epitaxially grown on STO, LAO and LAO/STO substrates. Compared to LAO and STO the LSMO films on LAO/STO shows a higher metal-insulator transition temperature and also an order of magnitude larger magnetization. The magnetic hysteresis loops measured in pinning fields show a large exchange coupling for the case of the LAO/STO substrate and the sign of the coupling supports a ferromagnet to a ferromagnet exchange. The magnetization measured arises from a combination of substrate magnetism and that of the film and the enhanced conductivity, metal-insulator transition temperature and magnetization can be accounted for by the exchange coupling between the magnetic phase observed in the LAO/STO interfaces and the LSMO layer. The decay length of this interaction in LSMO is 90 nm which is surprisingly much longer than has been observed in ferromagnetic metals. Furthermore, the discovery of a long range oscillatory magnetic exchange coupling with LAO thickness suggests a role for the LAO layer beyond a simple insulator in this magnetic heterostructure.

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