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Electronic Phase Separation at the $LaAlO_3/SrTiO_3$ Interface A. ARIANDO, X. WANG, Z.Q. LIU, J.B. YI, A. ANNADI, A. ROY BARMAN, A. RUSYDI, S. DHAR, Y.P. FENG, J. DING, T. VENKATESAN, National University of Singapore, Singapore, G. BASKARAN, The Institute of Mathematical Sciences, India, J. HUIJBEN, H. HILGENKAMP, University of Twente, The Netherlands
— Among the wealth of electronic and magnetic properties exhibited by complex oxides, electronic phase separation (EPS) is one of those whose presence can be linked to many types of exotic behavior, such as colossal magnetoresistance, metal-insulator transition and high-temperature superconductivity. Recently, the oxide community has once again been energized by the observation of a variety of new and unusual electronic phases at the interfaces between the complex oxides, in particular between two nonmagnetic insulators $LaAlO_3$ and $SrTiO_3$. However, no EPS has been observed thus far in this system despite a theoretical prediction. Here, we will show the observation of a ferromagnetic phase and its coexistence with a paramagnetic or a giant diamagnetic phase below 60 K at the interface between $LaAlO_3$ and $SrTiO_3$. The ferromagnetic phase persists even above room-temperature. The coexistence of these multiple magnetic phases along with the interface quasi- 2D electron gas suggests that EPS exists in this system, which can be explained on the basis of selective occupancy of interface sub-bands derived from the nearly degenerate t_{2g}-orbitals of Ti $3d$-states in the $SrTiO_3$.

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