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Localized electron states and phase separation at the $LaAlO_3/SrTiO_3$ interface S. SATPATHY, K.V. SHANAVAS, Department of Physics & Astronomy, University of Missouri — Even though the 2D electron gas at the polar interfaces of LAO/STO has been studied extensively, an explanation for the observed magnetic centers or the coexistence of magnetism and superconductivity is still lacking. Earlier density-functional calculations have indicated the presence of multi-bands and two types of electrons at the interface [1]. Here we propose that a combination of lattice disorder, octahedral rotations, and Jahn-Teller distortion can lead to some of these electrons to be localized near the interface and form lattice polarons. Evidence for this is presented from detailed density-functional calculations, which indicate that the energy gain associated with JT distortion and impurity or disorder induced local potentials can offset the kinetic energy cost of localization. Our model studies [2] also show the possible existence of a phase separation, thereby providing a natural explanation for the coexistence of magnetism and superconductivity [3].

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[2] B. R. K. Nanda and S. Satpathy *Phys. Rev B*, **83**, 195114 (2011)
[3] L. Li *et. al. Nature Physics*, **7**, 762 (2011); J. A. Bert *et. al. ibid*, 767 (2011);

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