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Parallel electron-hole bilayer conductivity from electronic interface reconstruction: Theory KATRIN OTTE, ROSSITZA PENTCHEVA, Section Crystallography, Dept. of Earth and Environmental Sciences, University of Munich, WARREN E. PICKETT, Department of Physics, UC Davis — The polar discontinuity in oxide heterostructures and thin films can lead to novel electronic states even if simple band insulators such as $LaAlO_3$ and $SrTiO_3$ are involved. Density functional theory calculations [1] show that a strong lattice polarization allows several layers of $LaAlO_3$ to remain insulating before an electronic reconstruction takes place at around 4 monolayers (MLs) [2]. Here we demonstrate that a capping $SrTiO_3$ layer can trigger the insulator-to-metal transition already at two MLs of $LaAlO_3$. A surface O $2p$ state is identified as the origin of this additional band shift. Altogether, a $SrTiO_3$-capping layer represents an alternative pathway to tune the electronic reconstruction of the system and to realize an electron-hole bilayer in the search, e.g., for novel excitonic phases.
[1] R. Pentcheva and W.E. Pickett, Phys. Rev. Lett. **102**, 107602 (2009).
[2] S.Thiel et al., Science **313**, 1942 (2006).

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