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Full electrostatic control of the band structure of the $LaAlO_3$-$SrTiO_3$ interface two-dimensional electron system[1] SANDER SMINK, JORRIT DE BOER, MARTIN STEHNO, ALEXANDER BRINKMAN, WILFRED VAN DER WIEL, HANS HILGENKAMP, Univ of Twente — The two-dimensional electron system at the interface between $LaAlO_3$ and $SrTiO_3$ has several unique properties that can be tuned by an externally applied gate voltage. Our magneto-transport data on top-gated Hall bars reveals a $d_{yz,xz}$ Lifshitz transition at a carrier density of 2.9 x 10^{13} cm^{-2} and a surprising reduction of d_{xy}-type carrier density with gate voltage above this transition. These observations indicate a gate-tunable band structure, which is controlled by the electrostatic confinement. This is supported by self-consistent Schrödinger-Poisson calculations, which reproduce the observed reduction of d_{xy}-type charge carrier density by including interband electronic correlations. In combination with back-gating, we show that the top-gated $d_{yz,xz}$ Lifshitz transition can be tuned by a back-gate voltage, establishing full electrostatic control of the band structure and confinement of the system. The expected effect of either a top- or back-gate voltage on the boundary conditions of the Schrödinger-Poisson model is confirmed by the experimental results.

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