Electronic properties of coupled interfaces in LaAlO$_3$/SrTiO$_3$ heterostructures

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The electron density at the LaAlO$_3$/SrTiO$_3$ interface is a function of the separation between the doped interface and a second interface [Nat.Mat. 5, 556-560]. Depending on the nature of the second interface, either $n$-type LaO$/\text{TiO}_2$ or $p$-type AlO$_2$/SrO, the electron doping decreases resp. increases with increasing interface separation. This observation can be explained by assuming a $p$-type interface acts as an electron sink, while a $n$-type interface acts as an electron source.

Here we extend the research to coupled interfaces with two $n$-type interfaces fabricated using pulsed laser deposition. Applying a microscopic dipole model to the polar discontinuity inherent to the system allows for the extraction of the binding energy for both cases. The positive value for $p$-type interfaces shows that electrons from the primary $n$-type interface are indeed trapped, while the negative value for the secondary $n$-type interfaces indicates that electrons are doped away from the donor interface.

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