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Electronic Structure, spin-orbit coupling and magnetotransport at the $LaAlO_3/SrTiO_3$ interface[1] DANIEL KESTNER, SUMILAN BANERJEE, MOHIT RANDERIA, The Ohio State University — We study the $LaAlO_3/SrTiO_3$ interface using self-consistent solution of the Poisson and Hartree-Fock equations in a tight-binding framework. We go beyond the analysis of ref.[1] by modeling the non-linear dielectric properties of STO using a Landau-Ginzburg-Devonshire theory with parameters determined from bulk measurements. We show that it is essential to also include the lifting of the Ti t_{2g} orbital degeneracy to match DFT results. This then allows us to investigate the density dependence of the electronic structure. We compare our results with the Lifshitz transition inferred from Hall data [2]. We calculate magneto-transport with an in-plane magnetic field and find a planar Hall effect and a magneto-resistance that oscillates with the magnetic field orientation due to the interplay of Zeeman and spin-orbit couplings. Finally, we comment on the nature of the spin-orbit coupling across the Lifshitz transition.

[1] M. Stengel, PRL 106, 136803 (2011); G. Khalsa, A.H. Macdonald, PRB 86, 125121 (2012); S. Y. Park, A. J. Millis, PRB 87, 205145 (2013).
[2] A. Joshua *etal.*, Nature Comm. 3, 1129 (2012).

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