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Localization and Magnetotransport at the $LaAlO_3/SrTiO_3$ Heterointerface FRANKLIN WONG, YURI SUZUKI, University of California, Berkeley, BERKELEY TEAM — Low-temperature electrical transport experiments of the metallic $LaAlO_3/SrTiO_3$ heterointerface have revealed a vast array of physical phenomena, including superconductivity, weak localization, and possible magnetic ordering. Through a study of $LaAlO_3$ films ranging from 1.6 to 15 nm grown on TiO_2-terminated (001) $SrTiO_3$ substrates, we show that there is an evolution of transport that converges when the film thickness reaches to 5-6 nm. In general, thicker samples have larger carrier densities, but lower low-temperature mobility values. In addition, field-dependent magnetoresistance data show that higher carrier density samples exhibit antilocalization effects. Together these results suggest greater disorder-induced elastic scattering and strong spin-orbit coupling, which may arise from large electric fields at the heterointerface. In contrast, lower carrier density samples exhibit large in-plane negative magnetoresistance and no features of antilocalization. Carrier density and disorder play prominent roles in determining the field-dependent carrier transport in the metallic conduction regime.

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