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**Local conductivity enhancement due to the tetragonal domain structure in $LaAlO_3$- $SrTiO_3$ heterointerfaces**[1]

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Progress in the difficult task of growing oxide heterostructures has enabled the field of oxide interface engineering. The ability to control materials properties through interface engineering is demonstrated by the appearance of conductivity at the interface of certain insulators, most famously the {001}interface of the band insulators $LaAlO_3$ (LAO) and $TiO_2$-terminated $SrTiO_3$ (STO). The prevailing explanation of conduction at the interface is electronic reconstruction due to a 'polar catastrophe' in which charge migrates from the top LAO layer to the interface. Transport and other measurements in this system display a plethora of diverse physical phenomena. To better understand the interface conductivity, we used scanning superconducting quantum interference device (SQUID) microscopy to image the magnetic field locally generated by current in an interface. At low temperature, we found that the current flowed in conductive narrow paths oriented along the crystallographic axes, embedded in a less conductive background. The configuration of these paths changed upon thermal cycling above the STO cubic to tetragonal structural transition temperature, implying that the local conductivity is strongly modified by the STO tetragonal domain structure. In this talk, I will summarize these results and also report on measurements of conductivity and diamagnetism in related materials that firmly establish the influence of the STO tetragonal domains on electronic properties.

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