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Non-Fermi liquids in two and three-dimensional doped SrTiO3.
EVGENY MIKHEEV, SANTOSH RAGHAVAN, JACK ZHANG, PATRICK MARSHALL, ADAM KAJDOS, Materials Department, University of California, Santa Barbara, CA 93106-5050, USA, LEON BALENTS, Kavli Institute for Theoretical Physics, University of California, Santa Barbara, California 93106-4030, USA, SUSANNE STEMMER, Materials Department, University of California, Santa Barbara, CA 93106-5050, USA — A remarkable feature of transport in doped $SrTiO_3$ is the temperature dependence of the electrical resistivity that is proportional to T^n with $n \leq 2$. This power law suggests electron-electron scattering is the dominant scattering mechanism. It extends to room temperature and above in both three-dimensional, uniformly doped $SrTiO_3$ and in two-dimensional electron liquids (2DELs) at oxide interfaces. In case of $n = 2$, the behavior is traditionally identified as that of a Landau Fermi liquid. Here we argue that Landau Fermi liquid theory does not apply to the electron liquid in $SrTiO_3$, even when $n = 2$. Using electrostatic gating and chemical doping, we demonstrate that this regime is associated with a scattering rate and an energy scale that are independent of carrier density. This is in fundamental conflict with the premise of the Fermi liquid theory, where this energy scale is the Fermi energy. This work raises important questions in terms of microscopic scattering mechanism. It appears to be relevant for understanding of transport in many other strongly correlated systems, which also show very robust T^n regimes with carrier density independent scattering rates.

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