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Separation of transport and Hall scattering rates in $SrTiO_3/ReTiO_3$ two-dimensional electron gases EVGENY MIKHEEV, BRANDON ISAAC, TYLER CAIN, CHRISTOPHER FREEZE, SUSANNE STEMMER, Univ of California - Santa Barbara — $ReTiO_3/SrTiO_3/ReTiO_3$ (Re=Gd, Sm) quantum well structures that contain a high-density, two-dimensional electron gas (2DEG) exhibit phenomena that are reminiscent of the normal state behavior of unconventional superconductors, including a pseudogap, proximity to two-dimensional antiferromagnetism, and non-Fermi liquid behavior. Here we will discuss another transport anomaly, namely that scattering rates measured in the longitudinal and Hall conductivities are distinct and have different temperature dependencies. We show that the two-scattering rate framework provides a remarkably simple, consistent, and accurate description for the dependencies of the Hall effect on temperature and quantum well thickness. This analysis reveals signatures of a spin density wave gap opening (Re=Sm) and a divergent Hall effect in the T=0 limit for an intermediate quantum well thickness (near 5 SrO layers), indicating a quantum critical point. Several theoretical proposals exist that may explain the two-lifetime separation. We discuss how the results in this system introduce a number of new, specific constraints and the need for a unifying microscopic theory.

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