Abstract Submitted
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Investigating the thermal stability of electron transport properties in modulation-doped semiconductor heterostructure systems[1] IAN PILGRIM, BILLY SCANNELL, University of Oregon, ANDREW SEE, University of New South Wales, RICK MONTGOMERY, PETER MORSE, MATT FAIRBANKS, COLLEEN MARLOW, University of Oregon, HEINER LINKE, Lund University, IAN FARRER, DAVID RITCHIE, Cavendish Laboratory, ALEX HAMILTON, ADAM MICOLICH, University of New South Wales, LAURENCE EAVES, University of Nottingham, RICHARD TAYLOR, University of Oregon — Since the 1950s, materials scientists have pursued the fabrication of solid-state heterostructure (HS) devices of sufficient purity to replicate electron interference effects originally observed in vacuum. The ultimate goal of HS engineering is to create a semiconductor "billiard table" in which electrons travel ballistically in a 2-D plane—that is, with scattering events minimized such that the electron's mean free path exceeds the device size. For the past two decades, the modulation-doped (MD) HS architecture has yielded devices supporting very high electron mobilities. In this architecture, ionized dopants are spatially removed from the plane of the electrons, such that their influence on electron trajectories is felt through presumably negligible small-angle scattering events. However, we observe that thermally induced charge redistribution in the doped layers of AlGaAs/GaAs and GaInAs/InP MD heterostructures significantly alters electron transport dynamics as measured by magnetoconductance fluctuations. This result demonstrates that small-angle scattering plays a far larger role than expected in influencing conduction properties.

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