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Antilocalization, quantum coherence and spin coherence in quasi-one-dimensional GaAs/AlGaAs hole wires[1] SHAOLA REN, J.J. HEREMANS, Virginia Tech, M. SHAYEGAN, Princeton University — Antilocalization is measured in quasi-1D (Q1D) lithographic wires fabricated on a GaAs/AlGaAs 2D hole system. Shubnikov-de Haas oscillations show substantial spin-orbit interaction in the asymmetric quantum well. A set of 10 Q1D wires of length 20 μm and conducting width 300 nm were fabricated. Mobility and density are preserved in the wires, which show predominantly specular boundary scattering, indicating high quality hole wires. Antilocalization is present in both the wires and the unpatterned system, confirming the existence of spin-orbit interaction. The spin and phase coherence times are measured as functions of temperature by fitting the magnetoconductance to antilocalization theory. Q1D antilocalization theory, as used on InSb and InAs wires, does not fit the hole wires well, likely due to a combination of ballistic transport and strong spin-orbit interaction not fully accounted for theoretically. For both wires and unpatterned system the measurements still indicate the spin coherence times and the phase coherence times with the expected temperature dependence. The measurements allow a comparison of the spin coherence times, and of their lengthening under dimensional confinement, with observations on other spin-orbit coupled 2D systems.

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