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Examining the weak localization and weak anti-localization in correlated semimetallic $SrIrO_3$ thin films LE ZHANG, XIAOZHE ZHANG, XUANYUAN JIANG, XIAOSHAN XU, XIA HONG, University of Nebraska - Lincoln — We have studied the weak localization (WL) and weak anti-localization (WAL) effects in epitaxial $SrIrO_3$ (SIO) thin films to probe the electron correlation and spin-orbit coupling (SOC). We deposited 2-30 nm SIO thin films on $SrTiO_3$ (001) substrates via off-axis RF magnetron sputtering, with c-axis (pseudo-cubic) growth and atomically smooth surfaces achieved. Resistance of the films shows a moderate decrease with decreasing temperature. Modeling the Hall effect result with the two-carrier model and assuming equal electron- and hole-densities, we extracted a carrier density of ~10^{20} cm^{-3} and comparable electron and hole mobility of ~50 cm^2/Vs. For films below 5 nm, we observed a slight resistance upturn at low temperature, which can be attributed to WL. The low temperature magnetoconductance (MC) (2-15 K) shows a transition from WAL to WL. By fitting the MC with the Maekawa-Fukuyama model, we extracted the inelastic dephasing time and spin relaxation time. While the inelastic field shows linear temperature dependence, suggesting electron-electron interaction as the phase breaking mechanism, the spin relaxation field exhibits quadratic temperature dependence. We also explore the effect of carrier doping on the spin relaxation time using the electric field effect approach.

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