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Study of spin interactions between InAs surface electrons and local magnetic moments by antilocalization measurements YAO ZHANG, R.L. KALLAHER, V. SOGHOMONIAN, J.J. HEREMANS, Virginia Tech — Spin-orbit coupled electrons in the InAs surface accumulation layer can be used as a sensitive system to experimentally study the interactions and exchange between electrons and local magnetic moments in semiconductors. We use antilocalization measurements as a probe of quantum states, by comparing measurements on patterned InAs accumulation layers where Sm^{3+}, Gd^{3+} and Ho^{3+} have been deposited, with those where no magnetic species are deposited. The randomly distributed ions modify the spin-orbit scattering time and the magnetic spin-flip time, identified via the antilocalization signal and characterized over temperature. The magnetic spin-flip time carries information about magnetic interactions. Experiments indicate that the spin-orbit scattering times display a weak temperature dependence. The Sm^{3+} and Gd^{3+} cases yield temperature-independent magnetic spin-flip times, while Ho^{3+} shows a spin-flip time obeying $T^{-1/2}$ at low temperatures. Similar results as observed in the Ho^{3+} case have in the literature been attributed to Kondo-like behavior. We thus interpret the results as indicative of a Kondo interaction with a Kondo temperature considerably above 5 K, of which antilocalization measurements can identify the low-temperature tail (partial support from DOE DE-FG02-08ER46532).

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