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Investigations of interactions between low-dimensional electron systems and magnetic surface species by antilocalization measurements YAO ZHANG, R.L. KALLAHER, J.J. HEREMANS, Virginia Tech, J. GILPIN, University of Dallas — Weak antilocalization (AL) is a sensitive probe of quantum states in two-dimensional electron systems (2DESs). In order to experimentally investigate interactions between conduction electrons and magnetic species, we compare measurements of AL in 2DESs where magnetic species have been deposited on the surface with those performed on samples where no magnetic species are present, and give two examples. AL yields a characteristic positive magnetoresistance in weak applied magnetic fields. We find that a square lattice of lithographically prepared 40 nm diameter, 25 nm thick CoFe discs on the surface of an InGaAs 2DES reduces the AL signal as compared to a InGaAs 2DES with bare surface. The reduced magnitude is a consequence of increased magnetic scattering from the CoFe discs. In contrast, randomly distributed Dy3+ ions on the surface of InAs result in a more pronounced AL signal in the InAs surface electron accumulation layer. Dy3+ ions are expected to increase both the spin-orbit scattering rate and the magnetic scattering rate. The increase in the AL signal is here attributed to a decrease in the spin coherence time.

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