Spin transport in the 2D Fermi gas

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We compute and measure the transport properties of two-dimensional ultracold Fermi gases during transverse demagnetization in a magnetic field gradient. Using a phase-coherent spin-echo sequence, we are able to distinguish bare spin diffusion from the Leggett-Rice effect, in which demagnetization is slowed by the precession of spin current around the local magnetization. When the two-dimensional scattering length is tuned to be comparable to the inverse Fermi wave vector, we find that the bare transverse spin diffusivity reaches a minimum of order $\hbar/m$. The rate of demagnetization is also reflected in the growth rate of the s-wave contact, which quantifies how scale invariance is broken by near-resonant interactions. Our observations support the conjecture that in systems with strong scattering, the local relaxation rate is bounded by $kT/\hbar$, in analogy with what is found in materials with T-linear resistivity.

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