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**Spin-Energy Correlation in a Weakly-Interacting; Degenerate Fermi gas**[1] SAEED PEGAHAN, JAYAMPATHI KANGARA, ILYA ARAKELYAN, JOHN E THOMAS, NC State University, JET LAB TEAM —
Active manipulation of spin and spin current can be used to transport information with low dissipation and for creating quantum-entangled states. We study the formation of spin-energy correlations in a weakly interacting Fermi gas of $^6$Li contained in an optical trap with a spin-dependent potential. A tailored radio-frequency pulse creates an initial coherent superposition of two spin states with a controllable spin-energy spiral. We observe the subsequent evolution of the spin-up and spin-down density profiles over 1000 ms, demonstrating a long coherence time. For both quantum-degenerate and thermal clouds we obtain excellent quantitative agreement with a new collision-less mean-field model of spin-energy correlation. Further, we precisely measure the magnetic field at which the s-wave scattering length vanishes (where spin segregation ceases) for both 1-2 and 2-3 hyperfine state mixtures, providing new constraints on the molecular potentials.

[1]Office of Science, U.S. Department of Energy, Physics division of the Army research office

Saeed Pegahan
North Carolina State University

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