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Spin-Polarized Fermi Gases in 1D, 3D, and Crossover Regimes[1]
JACOB A. FRY, MELISSA C. REVELLE, BEN A. OLSEN, RANDALL G. HULET, Rice University — We report recent results on mapping the superfluid transition as a function of atomic interaction and global spin polarization in a two-component, 3D gas of fermionic lithium. The atomic interactions are controlled using a Feshbach resonance to tune between the strongly interacting BEC regime and the weakly interacting BCS regime. Previously, a 3D gas was found to have an unpolarized superfluid core that is enclosed by polarized shells.[2] By applying a 2D optical lattice we confine our gas in one-dimensional tubes. In this 1D gas, in contrast to the 3D gas, we found a partially polarized superfluid core and either fully polarized or fully paired wings depending on the overall spin polarization.[3] In the current experiment, we have mapped the phase diagram of the 1D/3D crossover by increasing the inter-tube coupling. The exotic superfluid state, FFLO, is predicted to occupy a large portion of the phase diagram in the crossover regime, making it an ideal location in parameter space for its detection.[4]

[1]ARO, NSF, ONR, and The Welch Foundation
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[3]Y.A. Liao et al., Nature 467, 567 (2010).
[4]M. Parish et al., PRL, 99, 250403 (2007).

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