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Probing the 1D-3D Crossover of a Spin-Imbalanced Fermi Gas[1]

MELISSA REVELLE, BEN A. OLSEN, YEAN-AN LIAO, RANDALL G. HULET, Department of Physics and Astronomy and Rice Quantum Institute, Rice University, Houston, TX 77005 — We have previously mapped the phase diagram of a 1D spin-imbalanced Fermi gas by confining the atoms in an array of tubes using a 2D optical lattice.[2] Within each tube we observed separation of the atoms into a partially polarized superfluid core and fully paired or fully polarized wings (depending on the spin polarization). In 3D, the phase separation is inverted, such that the cloud center is fully paired.[3] We investigate the transition from a 1D to 3D gas by smoothly varying the lattice depth which changes the tunneling between the tubes. This allows us to study how the spin density changes as a function of inter-tube coupling. By varying the lattice depth quickly, we can measure the spin transport properties in a strongly interacting system. Progress will be reported.

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[2]Y.A. Liao et al., Nature 467, 567 (2010).
[3]G. B. Partridge et al., Science 311, 503 (2006); Y. Shin et al., Phys. Rev. Lett. 97, 030401 (2006).

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