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Investigation of the 3D to 1D Crossover of a Spin-Imbalanced Fermi Gas[1] TOBIAS PAPROTTA, YEAN-AN LIAO, ANN SOPHIE C. RITTNER, RANDALL G. HULET, Department of Physics and Astronomy and Rice Quantum Institute, Rice University, Houston, TX 77005 — Spin-imbalanced Fermi gases have been investigated in 3D geometries, for which phase separation into normal and superfluid phases has been observed[2]. More recently, we have mapped the phase diagram for the 1D gas, by confining the system to a 2D optical lattice, which creates an array of tubes[3]. In 1D, the spatial positions of the superfluid and normal gas are inverted, with the unpolarized superfluid occupying the trap edge, rather than the center. We investigate this dimensional crossover by tuning the depth of the lattice, which smoothly modifies the inter-tube tunneling. For sufficiently large tunneling rates, the system is effectively 3D. Spin transport velocities obtained from this study will allow better estimates of equilibration times in many types of optical lattice experiments.

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[2]G. B. Partridge et al., Science 311, 503-505 (2006); C.H. Schunck et al., Science 316, 867-870 (2007).
[3]Y.A. Liao et al., arxiv:0912.0092

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