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Superfluidity in Strongly Interacting Spin-Polarized Fermi Gases<sup>1</sup> BEN A. OLSEN, MELISSA C. REVELLE, JACOB A. FRY, RANDALL G. HULET, Department of Physics & Astronomy and Rice Quantum Institute, Rice University, Houston, TX 77005, DANIEL E. SHEEHY, Department of Physics & Astronomy, Louisiana State University, Baton Rouge, LA 70803 — We report measurements of the phase boundaries of a harmonically trapped, spin polarized two-component Fermi gas. The interactions in the gas are varied using a magnetically-tuned Feshbach resonance between the weakly-interacting BCS and strongly-interacting BEC regimes. Using spin-selective imaging, we measure the density profiles for the two lowest hyperfine levels of  $^{6}$ Li, with the superfluid phase being indicated by an unpolarized central core. We determine phase boundaries between the unpolarized superfluid, partially polarized, and ferromagnetic normal phases as functions of interactions and polarization. We find results that are consistent with earlier experimental results<sup>2</sup> as well as Quantum Monte Carlo (QMC) simulations<sup>3</sup> in the crossover regime. We explore the deep BCS regime, where few theoretical predictions are available, and also explore the BEC side of resonance, where we observe a superfluid core at higher polarization than predicted by QMC; we discuss the relative contributions of beyond-mean-field and temperature effects to this disparity.

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<sup>2</sup>M. Zwierlein et al., Science **311**, 492 (2006); N. Navon et al., Science **328**, 729 (2010)

<sup>3</sup>G. Bertaina and S. Giorgini, PRA **79**, 013616 (2009)

Ben Olsen Department of Physics & Astronomy and Rice Quantum Institute, Rice University, Houston, TX 77005

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