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Pair condensation of a spin-imbalanced two-dimensional Fermi gas DEBAYAN MITRA, PETER BROWN, STANIMIR KONDOV, PETER SCHAUSS, WASEEM BAKR, Princeton University — Strongly interacting Fermi gases of ultracold atoms are a clean and tunable platform for exploring high critical temperature superfluidity. This is particularly interesting because the physics of these gases has a close connection to superconductivity in strongly correlated materials. Early experiments in 3D gases have shed light on the crossover from BCS superfluidity to Bose-Einstein condensation of molecules and on the fate of superfluidity in spin-imbalanced gases. Here we study a strongly-interacting spin-imbalanced Fermi gas in two dimensions, where the low dimensionality enhances correlations and phase fluctations in the gas. We observe pair condensation in the imbalanced gas and map out the temperature-polarization phase diagram for a range of interactions strengths. At low temperatures, we observe phase separation between the superfluid and the normal gas over a wide range of imbalance. The measurement of the phase diagram of strongly interacting fermions in two dimensions opens the door for a detailed investigation of exotic phases enhanced in two dimensions and in optical lattices like the elusive FFLO phase.

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