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Pair condensation in a spin-imbalanced two-dimensional Fermi gas

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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 fluctuations in the gas. We observe pair condensation in the imbalanced gas and map out the critical polarization at which the condensate vanishes for different interaction strengths. At low temperatures, we observe phase separation between the superfluid and 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.

Biography

Waseem Bakr received his PhD from Harvard University in 2011. During his Doctoral thesis, he developed the technique of quantum gas microscopy for imaging atoms with single-site resolution in optical lattices. He used this technique to study quantum phase transitions in optical lattices in Hubbard models and in one-dimensional spin chains. Between 2011 and 2013, he was a Post-doctoral Researcher in Martin Zwierlein's group at MIT, where he experimentally explored strongly-correlated fermions, including experiments on lower dimensional gases and spin-orbit coupled systems. Since 2013, he has been an Assistant Professor in the Department of Physics at Princeton University.

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