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Superfluidity at the BEC-BCS crossover in two-dimensional Fermi gases with population and mass imbalance[1] GARETH CONDUIT, University of Cambridge, PETER CONLON, University of Oxford, BEN SIMONS, University of Cambridge — We explore the zero-temperature phase behavior of a two-dimensional two-component atomic Fermi gas with population and mass imbalance in the regime of the BEC-BCS crossover. Working in the mean-field approximation, we show that the normal and homogeneous balanced superfluid phases are separated by an inhomogeneous superfluid phase of Fulde-Ferrel-Larkin-Ovchinnikov (FFLO) type. We obtain an analytical expression for the line of continuous transitions separating the normal and inhomogeneous FFLO phases. We further show that the transition from the FFLO phase to the homogeneous balanced superfluid is discontinuous leading to phase separation. If the species have different masses, the superfluid phase is favored when the lighter species is in excess. We explore the implications of these findings for the properties of the two-component Fermi gas in the atomic trap geometry. Finally, we compare and contrast our findings with the predicted phase behavior of the electron-hole bilayer system. [1] Phys. Rev. A 77, 053617 (2008)

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