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BCS-BEC crossover induced by a synthetic non-Abelian gauge field[1] VIJAY B. SHENOY, JAYANTHA P. VYASANAKERE, Indian Institute of Science, S. ZHANG, Ohio State University — We investigate the ground state of interacting spin-$half$ fermions(3D) at a finite density ($\rho \sim k_F^3$) in the presence of a uniform non-Abelian gauge field (with magnitude λ) that generates a generalized Rashba spin-orbit interaction. For a weak attractive interaction in the singlet channel described by a small negative scattering length ($k_F|a_s| \lesssim 1$), the ground state in the absence of the gauge field ($\lambda = 0$) is a BCS superfluid with large overlapping pairs. With increasing λ, a non-Abelian gauge field engenders a crossover of this BCS ground state to a BEC ground state of bosons even with a weak attractive interaction. For large gauge couplings ($\lambda/k_F \gg 1$), the BEC attained is a condensate of bosons whose properties are solely determined by the gauge field (and not by the scattering length); we call these bosons "rashbons." In the absence of interactions ($a_s = 0^-$), the shape of the Fermi surface of the system undergoes a topological transition at a critical gauge coupling λ_T. For high symmetry gauge field configurations we show that the crossover from the BCS superfluid to the rashbon BEC occurs in the regime of λ near λ_T.

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