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Rashbons: Emergent bosonic fermion-pairs in synthetic non-Abelian gauge fields[1] JAYANTHA P. VYASANAKERE, VIJAY B. SHENOY, Indian Institute of Science Bangalore — In presence of a synthetic non-Abelian gauge field that produces a Rashba like spin-orbit interaction, a collection of weakly interacting fermions undergoes a crossover from a BCS ground state to a BEC ground state when the strength of the gauge field is increased [PRB **84**, 014512 (2011)]. The BEC that is obtained at large gauge coupling strengths is a condensate of tightly bound bosonic fermion-pairs called rashbons. This study reveals a new qualitative aspect that the rashbon state ceases to exist when the center of mass momentum of the fermions exceeds a critical value of the order of the gauge coupling strength. The study allows us to estimate the transition temperature of the rashbon BEC, and suggests a route to enhance the exponentially small transition temperature of the system with a fixed weak attraction to the order of the Fermi temperature by tuning the strength of the non-Abelian gauge field. The absence of the rashbon states at large momenta, suggests a regime in parameter space where the normal state of the system will be a dynamical mixture of uncondensed rashbons and unpaired helical fermions. Such a state should show many novel features including pseudogap physics.

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