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Title: “Marriage counseling for Cooper pairs: Condensation mechanisms in fermion systems with large flavor asymmetry”

Abstract: Systems of fermions with non-equal chemical potentials play an important role in the phenomenology of compact stars. Consequently this subject received much attention in the last decade. If the difference in the chemical potentials of two fermionic species is of the order of the superconducting gap, Cooper pairing breaks down. Above this 'Chandrasekhar-Clogston-limit' (CCl), conventional BCS condensation is not possible, but several alternative mechanisms of pairing have been proposed. They allow for superconductivity even in a (small) region above the CCl. In particular we discuss the 'Interior Gap', the crystalline 'Larkin-Ovchinnikov-Fulde-Ferrell (LOFF)' and the 'Deformed Fermi Surface (DFS)' phases, which are the most prominent candidates. Additionally we introduce and discuss another concept of superconductivity by considering Cooper-quartetting in strongly interacting asymmetric fermion systems. The presence of a phase featuring four fermion condensation, while the two fermion condensate vanishes, might lead to very interesting phenomenological consequences.