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Pairing of Fermions with Unequal Effective Charges in an Artificial Magnetic Field NUR UNAL, Cornell University, M. O. OKTEL, Bilkent University — Artificial magnetic fields (AMFs) created for ultracold systems depend sensitively on the internal structure of the atoms. In a mixture, each component couples to the AMF with a different charge. This enables the study of Bardeen-Cooper-Schrieffer pairing of fermions with unequal effective charges [1]. We investigate the superconducting (SC) transition of a system formed by such pairs as a function of the field strength. We consider a homogeneous two-component Fermi gas of unequal charges but equal densities with attractive interactions. We find that the phase diagram is altered drastically compared to the usual equal charge case. First, for some AMFs there is no SC transition and isolated SC phases are formed, reflecting the discrete Landau level (LL) structure. SC phases become reentrant both in AMF and temperature. For extremely high fields where both components are confined to their lowest LLs, the effect of the charge imbalance is suppressed. Charge asymmetry reduces the critical temperature even in the low-field semiclassical regime. We discuss a pair breaking mechanism due to the unequal Lorentz forces acting on the components of the Cooper pairs to identify the underlying physics. [1] F. Nur Ünal and M. Ö. Oktel, Phys. Rev. Lett. 116, 045305 (2016).

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