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Ferromagnetism versus Correlation in Strongly Repulsively Interacting Fermi Gases HUI ZHAI, Institute for Advanced Study, Tsinghua University, XIAOLING CUI, Beijing National Laboratory for Condensed Matter Physics and Institute for Physics, Chinese Academy of Science — Whether a spin-1/2 Fermi gas with strong repulsive interaction will become ferromagnetic is a long-standing controversial issue. Recently this problem has been studied experimentally by Jo et al., Science, 325, 1521 (2009) on fermi gases with large positive scattering length, and they attribute the observation to Stoner ferromagnetism. We first point out that the experiment evidence itself can hardly rule out the possibility of a non-magnetic but strongly short-range correlated state. We then construct variational wave function to study whether a fully polarized state is energetically stable against a single spin flip. Our variational wave function contains sufficient short-range correlation at least to the same level as Gutzwiller's projected wave function. For Hubbard lattice model and continuum model with pure repulsive interaction, we show a fully polarized Fermi gas is generally unstable even when the repulsive strength becomes infinite. While for a resonance model, it shows that ferromagnetic state is possible if the scattering length is positive and sufficient large, and the system is prepared in scattering state orthogonal to molecular bound state. However, we can not rule out the possibility that more exotic correlation can make the ferromagnetic state unstable.

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