Abstract Submitted
for the DAMOP12 Meeting of
The American Physical Society

Highly Polarized Fermi Gases across a Narrow Feshbach Resonance[1] RAN QI, HUI ZHAI, Institute for Advanced Study, Tsinghua University — We address the phase of highly polarized Fermi gases across a narrow Feshbach resonance starting from the problem of a single down spin fermion immersed in a Fermi sea of up spins. Both polaron and pairing states are considered using the variational wave function approach, and we find that the polaron to pairing transition will take place at the BCS side of the resonance, strongly in contrast to a wide resonance where the transition is located at the BEC side. For pairing phase, we find out the critical strength of repulsive interaction between pairs above which the mixture of pairs and fermions will not phase separate. Therefore, nearby a narrow resonance, it is quite likely that magnetism can coexist with s-wave BCS superfluidity at large Zeeman field, which is a remarkable property absent in conventional BCS superconductors (or fermion pair superfluids).

[1]This work is supported by Tsinghua University Initiative Scientific Research Program. Hui Zhai is supported by NSFC under Grant No. 11004118 and No. 11174176, and NKBRSFC under Grant No. 2011CB921500. Ran Qi is supported by NSFC under Grant No. 11104157.

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Date submitted: 12 Jan 2012 Electronic form version 1.4