Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Anomalous Dimers in Quantum Mixtures near Broad Resonances:Pauli Blocking, Fermi Surface Dynamics and Implications[1] JUNLIANG SONG, Institute of Quantum Optics and Quantum Information of Austrian Academy of Sciences, FEI ZHOU, University of British Columbia — We study the energetics and dispersion of anomalous dimers that are induced by the Pauli blocking effect in a quantum Fermi gas of majority atoms near interspecies resonances. Unlike in vacuum, we find that both the sign and magnitude of the dimer masses are tunable via Feshbach resonances. We also investigate the effects of particle-hole fluctuations on the dispersion of dimers and demonstrate that the particle-hole fluctuations near a Fermi surface (with Fermi momentum $\hbar k_F$) generally reduce the effective two-body interactions and the binding energy of dimers. Furthermore, in the limit of light minority atoms the particle-hole fluctuations disfavor the formation of dimers with a total momentum $\hbar k_F$, because near $\hbar k_F$ the modes where the dominating particle-hole fluctuations appear are the softest. Our calculation suggests that near broad interspecies resonances when the minority-majority mass ratio m_B/m_F is smaller than a critical value (estimated to be 0.136), dimers in a finite-momentum channel are energetically favored over dimers in the zero-momentum channel. We apply our theory to quantum gases of ^{6}Li^{40}K, ^{6}Li^{87}Rb, ^{40}K^{87}Rb and ^{6}Li^{23}Na near broad interspecies resonances, and discuss the implications.

[1]Austrian Science Fund FWF FOCUS

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Date submitted: 27 Nov 2011 Electronic form version 1.4