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Dynamic projection on Feshbach molecules: a probe of pairing and phase fluctuations EHUD ALTMAN, Department of Physics, Harvard University, ASHVIN VISHWANATH, Department of Physics, University of California at Berkeley — We describe and justify a simple model for the dynamics associated with rapid sweeps across a Feshbach resonance, from the atomic to the molecular side, in an ultra cold Fermi system. The model allows us to relate equilibrium properties of the initial state to properties of the final state, such as the fraction of condensed molecules, the momentum distribution of normal molecules and the conversion efficiency as a function of ramping rate. We find that this 'projection' onto molecules is a very sensitive probe of pairs (both condensed and non-condensed pairs) in the initial state, and arises ultimately from the short distance singularity of the Cooper pair wave function. We find that near the resonance, phase fluctuations sharply reduce the observed condensate fraction even at zero temperature. For very fast sweeps at low temperature, we predict a surprising nonmonotonic behavior of the molecule condensate fraction versus detuning of the initial state from resonance. In addition to probing the fermion pair condensate [1,2], this approach can detect noncondensed pairs, and possibly establish the presence of a phase fluctuation induced 'psuedogap' phase in these systems.
[1] C. A. Regal, M. Greiner, and D. S. Jin, Phys. Rev. Lett. 92, 040403 (2004). [2] M. Zwierlein, *et.al.*, Phys. Rev. Lett. 92, 120403 (2004)

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