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Effective Low-Dimensional Hamiltonian for Strongly Interacting Atoms in a Transverse Trap JASON KESTNER, LUMING DUAN, University of Michigan — We consider an ultracold, dilute gas of two-component fermions strongly trapped along one or two dimensions. In a previous work [1], we have shown that near a Feshbach resonance, the excited modes of the transverse trap are not frozen out, even for very strong trapping. Now, we form an effective low-dimensional Hamiltonian by introducing a dressed molecule state comprising a superposition of the Feshbach molecule and atomic Cooper pairs in excited trap modes. The transverse physics is thus incorporated via the structure of this dressed molecule state. The dressed molecule is localized in all dimensions to less than the trap length scale, so, for a dilute gas, its structure is determined solely by the two-body physics. Thus, by matching the two-body bound state of the effective Hamiltonian with the exact two-body bound state, we are able to fix all the parameters in the effective Hamiltonian. This should provide a useful starting point for understanding the low-dimensional many-body physics when the gas is near its ground state configuration.
[1] J.P. Kestner and L.-M. Duan, Phys. Rev. A 74, 053606 (2006).

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