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Quantum Monte Carlo study of the visibility of one-dimensional Bose-Fermi mixtures CHRISTOPHER VARNEY, University of California, Davis, VALERY ROUSSEAU, Instituut Lorentz, RICHARD SCALETTAR, University of California, Davis — The study of ultra-cold, optically trapped atoms has opened new vistas in the physics of correlated quantum systems. Much attention has now turned to mixtures of bosonic and fermionic atoms. A central puzzle is the disagreement between the experimental observation of a reduced bosonic visibility $\mathcal{V}_b$, and quantum Monte Carlo (QMC) calculations which show $\mathcal{V}_b$ increasing. In this talk, we present new QMC simulations which evaluate the density profiles and $\mathcal{V}_b$ of mixtures of bosons and fermions in one-dimensional optical lattices. We resolve the discrepancy between theory and experiment by identifying parameter regimes where $\mathcal{V}_b$ is reduced, and where it is increased. We present a simple qualitative picture of the different response to the fermion admixture in terms of the superfluid and Mott insulating domains before and after the fermions are included. Finally, we show that $\mathcal{V}_b$ exhibits kinks which are tied to the domain evolution present in the pure case, and also additional structure arising from the formation of composite boson-fermion particles.

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