Abstract Submitted
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Quantum Entangled Dark Solitons[1] LINCOLN D. CARR, Colorado School of Mines, RYAN V. MISHMASH, University of California, Santa Barbara, IPPEI DANSHITA, Boston University, CHARLES W. CLARK, Joint Quantum Institute, National Institute of Standards and Technology — We present a fully quantum many-body treatment of dark solitons formed by ultracold bosonic atoms in one-dimensional optical lattices [1,2]. Using time-evolving block decimation to simulate the single-band Bose- Hubbard Hamiltonian, we consider the quantum dynamics of density- and phase-engineered dark solitons as well as the quantum evolution of mean-field dark solitons injected into the quantum model. Quantum fluctuations cause the dark soliton to fill in and can induce an inelasticity in soliton-soliton collisions. Comparisons are made to the Bogoliubov theory which predicts depletion into an anomalous mode that fills in the soliton. Our many-body treatment allows us to go beyond the Bogoliubov approximation and calculate explicitly the dynamics of the system's natural orbitals. [1] Phys. Rev. Lett. **103**, 140403 (2009). [2] Phys. Rev. A **80**, 053612 (2009).

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