Abstract Submitted
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Wave function anatomy of ultracold fermions in a double well: Attractive-pairing, Wigner-molecules, and entanglement[1] BENEDIKT B. BRANDT, CONSATNTINE YANNOULEAS, UZI LANDMAN, School of Physics, Georgia Institute of Technology — We report on exact benchmark configuration-interaction computational solutions of the many-body Hamiltonian, uncovering the spectral evolution, wave function anatomy, and entanglement properties of a few interacting ultracold fermions in the entire parameter range, including crossover from an single-well to a double-well confinement and a controllable energy imbalance between the wells. According to recent experiments, the two wells are taken as quasi-one-dimensional and both the linear and parrallel configurations of them are considered. We demonstrate attractive pairing and formation of repulsive, highly correlated, ultracold Wigner molecules, associated with the emergence of Heisenberg spin chains.[2] For two fermions, the entanglement measure of the von-Neumann entropy is used as a diagnostic tool for identifying maximally entangled two-qubit Bell states.[3]

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[2]Yuesong Li, C. Yannouleas, and U. Landman, Phys. Rev. B **76**, 245310 (2007); Ying Li, C. Yannouleas, and U. Landman, Phys. Rev. B **80**, 045326 (2009)
[3]B.B. Brandt, C. Yannouleas, and U. Landman, Nano Lett. **15**, 7105 (2015).

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