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Pairing of few Fermi atoms in one dimension PINO D'AMICO, MASSIMO RONTANI, CNR-NANO S3, Via Campi 213A, 41125 Modena, Italy — Experimental advances allow us to confine a chosen number of few quantum degenerate Li6 atoms in a trap with unit precision down to the empty-trap limit. The Heidelberg group recently observed an even-odd oscillation of the "ionization" energy required to subtract an atom from a one-dimensional trap in the presence of moderate attractive interactions, which was attributed to pairing [PRL 111, 175302 (2013)]. Naively, one would expect pairing to be strongly suppressed in one dimension, due to the lack of orbital degeneracies. Here we address theoretically the pairing behavior of a few Fermi atoms in a one-dimensional harmonic trap through the exact diagonalization of the fully interacting Hamiltonian. From the analysis of exact ground- and excited-state energies and wave functions we extract both the pairing gap and the Cooper pair size, reproducing the observed even-odd behavior. Our results demonstrate that pairing in one dimension is a strongly cooperative effect that significantly deviates from the behavior predicted by perturbation theory at interaction strengths within experimental reach.

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