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Tunneling dynamics of two interacting one-dimensional particles[1]

SEYED EBRAHIM GHARASHI, D. BLUME, Washington State University — We present our results on simulation of the cold atom tunneling experiments by the Heidelberg group [G. Zürn *et al.*, Phys. Rev. Lett. **108**, 075303 (2012), G. Zürn *et al.*, Phys. Rev. Lett. **111**, 175302 (2013)] on one or two ^{6}Li atoms confined by a potential that consists of an approximately harmonic optical trap plus a linear magnetic field gradient. At the single particle level, we find that the WKB approximation may not be used as a reliable tool to extract the trapping potential parameters from tunneling data. We use our numerical calculations along with the experimental single particle tunneling rates to reparametrize the trapping potential. For two interacting atoms on the upper branch, we reproduce the experimental results. For infinitely strong interaction strength, we compare the time dynamics with that of two identical fermions and discuss the implications of fermionization for the dynamics. For two attractively interacting atoms on the molecular branch, we find qualitative agreement with experimental results. Pair tunneling dominates for strongly attractive interactions while single-particle tunneling dominates for weak interactions.

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