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Tunneling of two interacting atoms from excited states

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We consider a tunneling problem of two interacting cold atoms, with the even spatial symmetry, subject to an anharmonic optical trap and linear magnetic-field gradient. The atoms are initially prepared in the two lowest excited states with respect to relative and center-of-mass motions. We calculate the energy spectrum for a wide range of the interatomic coupling strength g. In the limit of zero coupling, an avoided crossing of the energy levels is revealed. We observe monotonic and non-monotonic dependence of a tunneling rate as a function of g. We find a condition to observe a transition from uncorrelated to correlated pair tunneling as a function of g and a size of the external trap barrier. This system, although for lower energy levels, has been recently investigated in the deterministic Heidelberg experiment using two interacting lithium-6 atoms.

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