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Efficient creation of maximally entangled states by modulation of tunneling rates

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For systems described by the two-site Bose-Hubbard Hamiltonian, we show that a sinusoidal modulation of the tunneling matrix element assists higher-order co-tunneling processes. Using this mechanism, we propose an efficient new scheme for creating a coherent superposition of states in which all particles are either on one site or all on the other site, the so-called NOON state. This scheme yields an almost perfect NOON state periodically. For larger numbers of particles, further reduction of the time to create the state is possible if more than one modulation frequency is employed. With this scheme, NOON states with a larger number of particles could be realized with state-of-the-art techniques for cold Bose gases in a double-well potential.

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