Abstract Submitted
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An experimental proposal to observe non-abelian statistics of Majorana-Shockley fermions in an optical lattice[1] DONG-LING DENG, SHENG-TAO WANG, KAI SUN, LU-MING DUAN, Department of Physics, University of Michigan, Ann Arbor, Michigan 48109, USA — Besides the conventional bosons and fermions, in synthetic two-dimensional (2D) materials there could exist more exotic quasi-particles with non-abelian statistics, meaning that the quantum states in the system will be transformed by non-commuting unitary operators when we adiabatically braid the particles one around another. The search for such non-abelian particles is of critical significance in the current investigation on quantum physics. Despite the recent great progress, it remains technically elusive to braid the quasi-particles in materials to verify their conjectured non-abelian statistics. Here, we propose an experimental scheme to observe non-abelian statistics with cold atoms in a 2D optical lattice. We show that the Majorana-Schockley modes associated with line defects can be braided with non-abelian statistics through adiabatic shift of the local potentials. Observation of the non-abelian statistics is of both fundamental interest and practical importance, in particular for topological quantum computation.

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