Non-Abelian Josephson effect and half vortex of cold atoms in traps and microcavities

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Abstract:

We investigate the non-Abelian Josephson effect in F=2 spinor Bose-Einstein condensates with double optical traps. We propose a real physical system which contains non-Abelian Josephson effect and has very different density and spin tunneling characters compared with the Abelian case. We calculate the frequencies of the pseudo Goldstone modes in different phases between two traps respectively, which are the crucial feature of the non-Abelian Josephson effect. We also give an experimental protocol to observe this novel effect in future experiments [1]. We also study Josephson effect for photons in two weakly linked microcavities [2], and quantum magnetic dynamics of polarized light in arrays of microcavities. We also investigate localization and the Kosterlitz-Thouless transition of fermion with disorder in hexagon lattices [3]. We investigate dynamic creation of fractionalized half-quantum vortices in Bose-Einstein condensates of sodium atoms. Our simulations show that both individual half-quantum vortices and vortex lattices can be created in rotating optical traps when additional pulsed magnetic trapping potentials are applied. We also find that a distinct periodically modulated spin-density-wave spatial structure is always embedded in square half-quantum vortex lattices. This structure can be conveniently probed by taking absorption images of ballistically expanding cold atoms in a Stern-Gerlach field [4].

References:

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