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Chiral-symmetry-protected dressed states of giant atoms

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In the previous work Rhy. Rev. Lett 126, 063601, we have established a general framework for studying vacancy-like dressed state (VDS) in a generic photonic bath coupled to a normal atom. Here we extend this theory to giant-atom case. We point out that only if a giant atom is coupled to a bath whose energy spectrum possess chiral-symmetry (not necessarily transitionally invariant) and the atom's translation frequency is centralized at zero-energy, then a chiral-symmetry-protected VDS must exist. Exotic properties of VDSs can be realized via a simple pair of standard homogenous photonic lattices coupled to giant atoms (with each atom being coupled to both lattices). Additionally, we find that a tunable phase between the giant-atom coupling points can control the strength of the interatomic potential and make it time-reversal breaking. The properties of the dressed-state in squre lattices are also studied.

Abstract category

Quantum Optics

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