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Compact localized modes in Dice lattice dressed by artificial flux

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Flat-band (FB) photonic lattices are attracting substantial attention of researchers since they provide an excellent platform for studying various fundamental physical phenomena difficult to achieve in the condensed matter systems. In that regard, some of those phenomena demonstrated in the last two decade are discrete solitons, dynamical localization and Anderson localization in disordered lattices [1]. One of the advantages of photonic lattices is that they are easy to manipulate with. Maybe the most important property of FBs is that they can host a complete set of compact localized states (CLS), highly robust to environmental noise.

Here, we investigate the CLS in two-dimensional (2D) dice lattice dressed by artificial flux in the presence of nonlinearity. Due to the Aharonov-Bohm (AB) caging effect, this lattice can host a fully FB spectrum [2]. The FB eigenmodes are compact snowflake-like structures shared by a few unit cells [3]. The goal is to find suitable conditions for selecting the localized states with user-friendly characteristics. We do this by testing the dynamics of those snowflake-like CLS in the linear and nonlinear regime. We have found two types of dynamics of compact structures, one, the snowflake-like, robust in both linear and nonlinear regime, and the other one, breathing complexes, robust only in the presence of weak nonlinearity.

References

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2. J. Vidal, R. Mosseri, and B. Douçot, *Phys. Rev. Lett.* 81, 5888 (1998).
3. S. M. Zhang and L. Jin, *Phys. Rev. B* 102, 054301 (2020).

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