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Existence and dynamics of eigenmodes in linear flux dressed two-dimensional plus lattice

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Flatband (FB) photonic systems have been in the spotlight of researchers since they represent an advantageous testbed for studying transport and localization properties at the linear level [1]. Among variety of platforms where flatbands have been realized photonic lattices have been established as the ideal ones, since working with them is very comfortable - they are easy to manipulate with and it is possible to directly observe the wave dynamics. Due to their geometry, it is possible to design artificial gauge field effects which are equivalent to the magnetic field flux, i. e. the spin-orbit interaction in atomic systems [2].

Here, we study a two-dimensional (2D) pluslike lattice [3], dressed by the artificial flux, which could be realized by experimental techniques based on the coupled-spring resonators [4] and wave-guide networks [5]. We investigate the influence of the artificial flux on the energy band spectrum and the idea is to find the compact localized modes (CLM).

The unit cell of the plus lattice consists of five sites, with real intra-cell hopping represented by the coupling coefficient. The flux of the artificial field modifies the coupling between different unit cell sites to $t\cdot\exp(\pm i\phi/4)$, where tis the hopping parameter and ϕ is the artificial flux. In the absence of flux, in the uniform lattice, the energy spectrum has one fully degenerate FB, centered at zero, between two dispersive bands (DBs), each of which is being accompanied with the other mirror symmetric DB [3]. We have found that 2D plus lattice can be dressed by artificial flux to host the Aharonov-Bohm (AB) effect. This effect causes the appearance of flat zones in the energy spectrum of the lattice. Hence, when diamond plaquettes are dressed by artificial flux $\phi=\pi$, this lattice spectrum is described by two momentum independent, fully degenerated FBs, and three DBs.

The dynamics of CLMs in 2D flux-dressed plus lattice can be analyzed numerically, adopting the Runge-Kutta procedure of the 6th order. In order to scan the dynamical properties of the CLMs we will calculate some of the following quantities: the participation number, which is a measure of the mode localization; the mode overlapping, which represents normalized magnitude of the field overlap; and total intensity distribution. The evolution of these quantities will show the efficiency of the mode compactness-localization.

References

1. D. Leykam, A. Andreanov, and S. Flach, Advances in Physics:X 3, 1 (2018).
2. S. Lisi et al., Nature Phys. 17, 189 (2021).
3. M. Stojanović Krasić et al., Phys. Rev. E 102, 032207(2020).
4. D. Leykam and L. Yuan, Nanophotonics, 9, 4473 (2020).
5. L. Morales-Inostroza and R. A. Vicencio, Phys. Rev. A, 94, 043831 (2016).

Primary authors: Dr MALUCKOV, Aleksandra (COHERENCE, Department of Atomic Physics, Vinča Institute of Nuclear Sciences, National Institute of Republic of Serbia, University of Belgrade, P.O. Box 522, 11001 Belgrade, Serbia); Prof. MANČIĆ, Ana (COHERENCE, Department of Physics, Faculty of Sciences and Mathematics, Višegradska 33, 18000 Niš); STEPIĆ, Milutin (COHERENCE, Department of Atomic Physics, Vinča Institute of Nuclear Sciences, National Institute of Republic of Serbia, University of Belgrade); Mrs STOJANOVIĆ, Mirjana G. (COHERENCE, Department of Atomic Physics, Vinča Institute of Nuclear Sciences, National Institute of Republic of Serbia, University of Belgrade, P.O. Box 522, 11001 Belgrade, Serbia)

Presenter: STEPIĆ, Milutin (COHERENCE, Department of Atomic Physics, Vinča Institute of Nuclear Sciences, National Institute of Republic of Serbia, University of Belgrade)

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