Book of abstracts

PHOTONICA2019

The Seventh International School and Conference on Photonics, 26 August – 30 August 2019, Belgrade, Serbia

& Machine Learning with Photonics Symposium (ML-Photonica 2019)

& ESUO Regional Workshop

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Editors: Milica Matijević, Marko Krstić and Petra Beličev

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Localized modes in two-dimensional octagonal-diamond lattices

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Two-dimensional octagonal-diamond (OD) atomic lattices have been explored in recent times to study phenomena related to topological phase transitions induced by spin-orbit interaction and gauge fields [1], and magnetic phases and metal-insulator transitions with Hubbard interaction [2, 3]. It can lead to the appearance of nontrivial nearly flat band states with particular topological properties [4]. Here we study the octagonal-diamond photonic lattice formed of linearly coupled waveguides, proposed by [4] as a possible experimental realization of an artificial flat-band system.

We investigated analytically and numerically the existence and stability of linear and nonlinear localized modes in a two-dimensional OD lattice. The primitive cell consists of four sites, linearly coupled with each other with the same coupling constant, including two diagonal couplings. The eigenvalue spectrum of the linear lattice consists of two flat bands and two dispersive bands [4]. The upper dispersive band intersects the upper flat band in the middle of the Brillouin zone, as well as the second flat band at the end of the Brillouin zone. In the linear case, there are two types of localized linear solutions, which are composed of eight sites each, having either monomer (+ - + - + - + -) or dimer (+ + - - + + - -) staggered phase structure [4]. In the presence of Kerr nonlinearity, both focusing and defocusing, compacton-like solutions [5] may exhibit instabilities due to intersections of the upper dispersive band and the flat bands. We also discuss the possibility of finding soliton solutions in the frequency gaps occurring between the flat bands and the isolated dispersive bands.

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