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ABSTRACT BOOK

ABSTRACT BOOK OF
RIAO - OPTILAS 2016,
IX IBEROAMERICAN OPTICS MEETING
AND
XII LATIN AMERICAN MEETING ON OPTICS, LASER AND APLICATIONS

NOVEMBER 21 to 25, 2016

PUCON, CHILE

TOPICS

IX Iberoamerican Optics Meeting / XII Latinoamerican Meeting on Optics, Lasers and Applications

RIAO Optilas2016

IX Reunión Iberoamericana de Optica / XII Encuentro Latinoamericano de Optica, Láseres y Aplicaciones

Edited by

Paz Moraga Sabaj

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Optics, Lasers and Applications (RIAO-OPTILAS 2016)

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The papers published in this book are the Abstracts of the IX Ibero-American Conference on Optics and XII Latin American Meeting on Optics, Lasers and Applications. Papers were selected by the Conference Committees to be presented in oral or poster format, and were subject to review by the editors and program committee. They are exclusive responsibility of the authors and are published herein as submitted, in interest of timely dissemination.

Please use the following format to cite material from this book:

Author (s). Title of Paper. Abstract Book of RIAO-OPTILAS 2016, Moraga, P. and Saavedra, C.; 21-25 November; CEFOP-UdeC-Concepción - Chile 2016. Page numbers.

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FOREWORD

We are very glad that, for the first time, the series of conferences RIAO-OPTILAS takes place in Chile, something we wanted to achieve as a result of both the fast development of Optics and Photonics in Chile during the past ten years and our commitment for the enhancement of theoretical studies, experimental research studies and for the search for novel applications.

We would like to acknowledge the contribution of several organizations and institutions that made possible a successful organization of the current version of RIAO/OPTILAS, among them we wish to thank: Advanced Optics MSI-Nucleus; International Council for Optics, Óptica Pura y Aplicada; Optical Society of America; Red Iberoamericana de Óptica; Universidad de Chile; Universidad de Concepción; Universidad de Los Andes; Universidad de Valparaiso; Universidad de la Frontera; Universidad de Valencia; SPIE, and the US Navy. We also want to thank the following enterprises: CIENTEC, HORIBA and THORLABS. This collaboration has allowed us, for instance, to provide seventy scholarships for students presenting their recent research achievements.

We also thank the collaboration of the members of the Scientific Committee for their contribution on reviewing the research articles as contributions to the conference. In this opportunity, the conference has been mainly organized by the Center for Optics and Photonics, Universidad de Concepción, Chile. In particular we wish to acknowledge all the administrative staff of the Center for their stellar effort, which resulted in the best possible organization of this conference.
We welcome all attendees to RIAO-OPTILAS and we look forward to a fruitful week of interactions and the enjoyment of science and technological advances.

Carlos Saavedra

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Light Localization in Nonlinear Binary Two-Dimensional Lieb Lattices

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Light localization in photonic lattices (PLs) is a well-known phenomenon which has been in-vestigated during decades. It has been shown that light localization in the linear regime can be achieved by designing PLs with specific geometries, instead of embedding defects or disorder in otherwise periodic lattices [1]. These geometries provide conditions necessary for destructive wave interference, leading to formation of a perfectly flat (dispersionless) energy band. Eigenvectors as-sociated to the flat-band (FB) eigenfrequencies are entirely degenerate and compact states (FB modes) and any superposition of them is nondiffracting. One of the simplest FB lattice patterns is the two-dimensional (2D) Lieb lattice [2,3] in which the primitive cell contains three sites. By ap-propriate spatial repetition of this fundamental block, it is possible to achieve a FB in the energy spectrum. Light confinement in PLs can also be a consequence of the interplay between nonlinearity and diffraction when these effects cancel each other, leading to formation of solitons. Recently, it has been reported that nonlinearity and "binarism" in quasi-one-dimensional FB systems can in-crease the range of existence and stability of FB ring modes [4].

We model a 2D binary Lieb lattice with nonlinearity of Kerr type and analyse numerically and analytically the existence, stability and dynamical properties of various localized modes found to emerge in spectrum. From the derived dispersion relation we found that binarism does not affect the FB. However, due to the presence of additional periodicity, new gaps occur in the energy spec-trum above and below the FB and their widths depend on the ratio between coupling constants. Like in the uniform Lieb lattice, we found eigenmodes in the form of a staggered four-peak "ring" structure, but only under certain conditions which require a particular relation between the field am-plitudes in neighbouring sites. In the nonlinear regime, ring modes survive in the uniform Lieb lat-tice but lose their stability moving away from the FB. On the other hand, nonlinearity destroys the existence of ring solutions in the binary Lieb lattice, leading to a new class of stable localized solutions which can be found in minigaps. As in previous kagome and ladder binary nonlinear strips [4], it is shown that the binarism increases the existence range of stable nonlinear localized solutions.

Keywords: Flat-band systems; Light localization; Nonlinearity

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