BPU11 CONGRESS
The Book of Abstracts

Editors:

Antun Balaž
Goran Djordjević
Jugoslav Karamarković
Nenad Lazarević

Belgrade, 2022

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The 11th International Conference of the Balkan Physical Union
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- The European Physical Journal (EPJ)

Contents

Preface

Dear colleagues and readers,

The Abstract book of the BPU11 Congress, which you are holding in your hands, aims to provide you with more information regarding the scientific program and the scientific contributions that are going to be presented at the Congress, as well as at the parallel and satellite events.

The BPU11 Congress is part of the series of general conferences of the Balkan Physical Union (BPU) which were firstly organized in Thessaloniki, Greece in 1991. Due to the COVID-19 pandemic, BPU11 is held now, in 2022, in a hybrid format with more than 450 registered participants, instead of being held in 2021 as it was primarily scheduled.

The scientific program is comprised out of 15 different scientific sections, 13 plenary lectures, 21 invited talks, a special FRONTIER session, 5 round tables and 2 workshops for teachers.

There will be more than 300 presentations in total. There are 109 oral presentation and 159 poster presentations which were accepted by the International Scientific Committee (ISC) for presenting.

We wish to express our sincerest gratitude to the International Advisory Committee (IAC) with 60 confirmed members, which is co-chaired by the academician Zoran Popović and professor Radu Constantinescu, the ISC with 151 members, which is co-chaired by professors Antun Balaž, Jugoslav Karamarković, and Nenad Lazarević. We would also like to thank the International Organizing Committee (IOC), country coordinators and last but not least, the Local Organizing Committee (LOC) chaired by professor Dragoljub D. Dimitrijević.

I would personally like to thank professor Luc Berge, the president of the European Physics Society (EPS) and the cochairmen of the BPU11 IOC. Additionally, I would like to express my gratitude to Mr. David Lee, Secretary General of EPS, for his continuous support of the BPU and other regional associations in the Balkans.

The BPU11 Congress would not have been made possible without the great support of our institutional co-organizers:

The main host, the Serbian Academy of Science and Arts (SASA), Faculty of Sciences and Mathematics-University of Niš, Faculty of Physics-University of Belgrade, Mathematical Institute of Serbian Academy of Sciences and Arts (National Institute of the Republic of Serbia), which are also the co-hosts of the Congress; Faculty of Mathematics-University of Belgrade, Faculty of Sciences-University of Novi Sad, Faculty of Science-University of Kragujevac, Faculty of Sciences and Mathematics-University of Pristina in Kosovska Mitrovica, the

SEENET-MTP Centre, and last but not least, Vinča Institute of Nuclear Science (National Institute of the Republic of Serbia).

We would also like to thank the Institute of Physics Belgrade, National Institute of the Republic of Serbia, for their great scientific contribution that attributed to the success of the Congress.

Furthermore, it is important to note the EPS has greatly contributed to the organization of the BPU11 Congress, as well as the previous congresses, and helped to support it financially.

The Congress, its parallel, and satellite events are internationally broadcast and financially supported by: The International Center for Theoretical Physics (ICTP) Trieste, the Central European Initiative (CEI) Trieste, Conseil Européen pour la Recherche Nucléaire (CERN) in Geneva.

We are also very much indebted to the European Physics Journal (EPJ) for the sponsorship that will provide the awards for the best the poster presentations awards at the BPU11 Congress.

We would also like to thank the Ministry of Education, Science and Technological Development of the Republic of Serbia and the Provincial Secretariat for Higher Education and Scientific Research, Autonomous Province of Vojvodina, Republic of Serbia, for the valued financial support they have provided us with so far.

Finally, we would like to share with you the brief history of the BPU and to say a few words regarding its future: The BPU was firstly initiated by professors Aleksandar Milojević and Djordje Bek-Uzarov, in 1985, and established two years later in Bucharest, Romania, in 1987. BPU is a regional Union of 10 Physics societies. I am more than pleased to say that the BPU was recently, institutionally lifted to a higher level, and that it became a legal entity in June 2022, with its Headquarters at the Department of Physics, Aristotle University, Thessaloniki, Greece. The 4th edition of the Balkan Physics Olympiad which will take place in Cyprus, this October, proves that the BPU has established a strong foundation, and that there is an excellent reason to optimistically look forward towards the future of the BPU and its cooperation with its numerous partners from Europe and all over the world.

Niš, Serbia, 18 August 2022
Prof. Dr. Goran S. Djordjević
President of the Balkan Physical Union

type of dispersion changes from normal to anomalous. Also, the values of detuning, depending on laser intensity, where superluminal or subluminal light is observed, were found.

Our study consists of analytical approach and numerical simulations. For simulations we used the parameters of the real two level physical system in ^{87}Rb atoms: $5S_{1/2}(F = 1, m_F = 1) \rightarrow 5P_{1/2}(F = 2, m_F = 0)$.

S07-OP-207 / **Poster presentation**

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

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Presenter: M. Stepić (mstepic@vinca.rs)

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·exp(±iϕ/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.

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S07-OP-208 / **Poster presentation**

Experimental demonstration of coherent beam recombination after controllable beam break-up and filamentation by using optical vortex lattices

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Coherent beam combining (CBC) is denoting a group of methods developed for achieving higher power/energy and for enhancing the spectral brightness of laser emission at preserved beam quality by combining several high-power laser beams (or sub-beams) [1]. On the other hand, the spectral broadening of coherent optical pulses is inevitably necessary for their compression in time. The beam filamentation is a complex nonlinear process (see e.g. [2]), potentially promising for the subsequent pulse compression. This makes sense only if there is a reliable way to coherently recombine the sub-beams after their spectral broadening for following pulse compression prior entering the interaction zone in the experiment.

The controllable (and reversible) beam break-up of optical vortex lattices in the focal plane of a lens (i.e. in the artificial far field) to an ordered structure of well-formed