an overview of optical BIC research and then discuss our recent results aimed at marrying BICs with non-Hermitian photonics. In particular, we consider a PT-symmetric layered structure (system with balanced loss and gain) with the outer layers possessing permittivity near zero. We theoretically show that this system supports PT-symmetry-enabled quasi-BICs which occur in spectra as high-quality resonances with almost perfect transmission and strong light localization and with the non-Hermiticity parameter governing the value of Q factor. Then, we introduce the asymmetry (geometric or non-Hermitian) to the system, which can be used to restore the Q factor of the resonance, and show that the system in this case behaves as a coherent perfect absorber and a laser simultaneously. Moreover, the counter-intuitive effect of loss-induced-lasing is found for the non-Hermitian asymmetry as well. We discuss the topological difference between the quasi-BICs with symmetric profile and the asymmetric Fano resonances in this system showing that they have different winding numbers. Finally, the applications of these BIC-supporting systems to sensing are briefly discussed.

Gluon dominance model and multiplicity distributions of hadrons

Elena Kokoulina
Joint Institute for Nuclear Research, Dubna, Russia
kokoulina@jinr.ru

Into frameworks of the gluon dominance model multiplicity distributions of charged particles are described. The main results of the comparison with experimental data are presented.

Modern tools for mathematical modelling of electronic amplifiers and generators of coherent radiation

Svetlana Sytova
Institute of Nuclear Problems of the Belarusian State University, Minsk, Belarus
sytova@inp.bsu.by

We consider the problems arising from the widespread use of ready-made software packages in mathematical modelling of various electronic amplifiers and generators, including volume free electron lasers. Many of such software products are commercial and have a high cost. But even using freely distributed software packages, due to their complexity and insufficient flexibility, significant efforts are often required to configure the input parameters of these codes to obtain adequate results of modelling the physical processes under consideration. Often, researchers, using such complex software packages, try to work without formulating systems of equations describing the physical processes under consideration, trusting the developers. This can lead to some non-physical results. That is why many researchers use their own software packages. The above reasoning is also valid for other areas of mathematical modelling of physical processes. This topic is important for students and postgraduates of physical and mathematical profiles who in the future plan to connect their activities with mathematical modelling of various physical phenomena and devices, as well as for researchers whose task is to study various physical laws using mathematical modelling methods.

Chaotic mappings for images encrypting

A.V. Sidorenko, I.V. Sergeev
Belarusian State University, Minsk, Belarus
sidorenkoa@yandex.by

The issues concerning the use of chaotic mappings, including Arnold's cat map, Henon map and the logistic map for encrypting information in the form of images are considered. To demonstrate the capabilities of the aforementioned algorithms, a computer program has been implemented in Phyton. Test images: Horizon Zero.png of size 250x250 pixels, Peppers.png of size 435x435 pixels, Squirrel.png of size 3489x2160 pixels are used.

The developed software has been tested. According to the requirements the histograms of the images and the autocorrelations of the three images used in the work have been defined, the results of which indicate the effectiveness of the proposed program.