**BOSE-HUBBARD MODELS WITH ON-SITE AND NEAREST-NEIGHBOR INTERACTIONS: EXACTLY SOLVABLE CASE**

S.N. Lakaev 1, Sh.Y.Kholmatov 2, Sh.I. Khamidov 1

*1Samarkand State University, Samarkand, Uzbekistan; 2 University of Vienna, Vienna, Austria*

 E-mail: slakaev@mail.ru

We study the discrete spectrum of the two-particle Schrodinger operator depending on the quasi-momentum associated to the Bose-Hubbard Hamiltonian of a system of two identical bosons interacting on one site and nearest-neighbor sites in the two-dimensional lattice with arbitrary interaction magnitudes. We completely describe the spectrum of Schrodinger operator with zero quasi-momentum and establish the optimal lower bound for the number of eigenvalues of Schrodinger operator outside its essential spectrum for all non-zero values of quasi-momentum.



*Fig. 1. Logo of the Nucleus-2022 conference.*

Namely, we partition the interaction parameters plane such that in each connected component of the partition the number of bound states of Schrodinger operator with non-zero quasi-momentum lying below or above its essential spectrum cannot be less than the corresponding number of bound states of the operator with zero quasi-momentum lying below or above its essential spectrum, respectively.

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