LIGHTEST KAONIC NUCLEI

Kezerashvili R.Ya.[1,2], Tsiklauri Sh.M.[3]
[1]*New York City College of Technology, The City University of New York, New York, USA;*
[2]*Graduate School and University Center, The City University of New York, New York, USA;*
[3]*Borough of Manhattan Community College, The City University of New York, New York, USA*
E-mail: rkezerashvili@citytech.cuny.edu

Nowadays, the study of kaonic nuclear states is an important topic in hadron physics, because their existence is related to kaon condensation and to the physics of the core of neutron stars that by todays understanding are built up from exotic matter: pion and kaon condensates and quark matter. We address the hottest topic in nuclear physics – lightest kaonic nuclei that consist from kaons and a few proton and neutrons. The current status of the experimental and theoretical studies of the lightest kaonic nuclei is presented. Particularly a quantitative and qualitative understanding of an antikaon-two-nucleon and antikaon-three-nucleon quasibound states are considered. The review of studies of three- and four-body kaonic nuclei within well-known model-independent methods of Faddeev equations and the hyperspherical function method, as well as variational method are presented. The theoretical discrepancies in the binding energies and widths for kaonic nuclei related to the different K*N* and KK interactions are discussed.

We present our study of kaonic three-body K^- *NN*, K^-K^-N and K^- K^+ K^+ and four-body K^-NNN, K^-K^- *NN* and $K^-K^-K^-N$ nuclei within the method of hyperspherical functions in momentum representation, using realistic local and separable potential models for the nucleon-nucleon and kaon-nucleon interactions, as well as for the kaon-kaon interaction. We solve nonrelativistic three- and four-body Schrodinger equation in momentum representation in the framework of the method of hyperspherical harmonics to find a ground state binding energy and corresponding wave function. We calculate the deeply bound state and width of three- and four-body kaonic nuclei. The following ground-state binding energies were obtained: 48.3 MeV (K^-pp), 28.2 MeV (K^-K^-p), 67.2 MeV (K^-ppn), and 89.3 MeV (K^-K^-pp), which are in good agreement with previous results obtained for the same potentials using Faddeev equations and variational method.