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Investigation of the structure of the few body Kaonic Nuclei using the method of hyperspherical functions in momentum space

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Collaboration

Abstract content

Kaonic three-body $K^{\bar{}}NN$, and of four-body $K^{\bar{}}NNN$ and $K^{\bar{}}K^{\bar{}}NN$ nuclei are studied 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. The following ground-state binding energies were obtained: 48.3 MeV ($K^{\bar{}}pp$), 28.2 MeV ($K^{\bar{}}K^{\bar{}}p$), 67.2 MeV ($K^{\bar{}}ppn$), and 89.3 MeV ($K^{\bar{}}K^{\bar{}}pp$), which are in good agreement with previous results obtained for the same potentials using Faddeev equations and variational method. There are severe theoretical discrepancies relating to the binding energy of kaonic nuclei, coming from the different KN and KK interactions. For Argonne V18 potential NN separable and one channel (N. Shevchenko, Phys. Rev. C 85, 034001 (2012) separable potentials gives the binding energy 23.4 MeV (KNN). Using realistic AV4 NN (Wiringa, Pieper, Phys. Rev. Lett. 89, 182501, 2002) potential and energy dependent chiral KN and KK local potentials (Barnea et al, Phys. Lett. B 712, 132, 2012) we received the following results of the binding energies 13.9 MeV $(KNN)\{\frac{1}{2},0\}, 27.3 MeV (K\ NNN)\{I=0\} and 30.4 MeV(\ K\hat{}\bar{}KNN\ )\_\{I=0\}$. The results of our calculations are in agreement with results of Shevchenko and Barnea et al. The experimental evidences to support theoretical predictions are discussed. This research is supported by CUNY Research Grant (C3IRG) : award # 64197-00 42.

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