Project Title

Study of deeply bound $K^-pp$ and $K^-NNN$ kaonic nuclei using hyperspherical harmonics

Participating Faculty

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(Please insert additional PIs as necessary)

Abstract (200 words maximum):

In this proposal we address the hottest topic in nuclear physics - kaonic nuclei that consist from kaons and proton and neutrons. Particularly a quantitative and qualitative understanding antikaon-two-nucleon and antikaon-three-nucleon quasibound states are attempted. We solve nonrelativistic three- and four-body Schrödinger equation in momentum space, the framework of the method of hyperspherical harmonics (HH), using the separable antikaon-nucleon interaction and realistic nucleon-nucleon interaction in momentum space. This is the first time when the HH microscopic method is applied to study kaonic nuclei. We calculate the deeply bound state and width of three-body kaonic nucleus $K^-pp$ and result of calculations will be compared with existing calculations and experimental data. The uncertainties that are due to unknown antikaon-nucleon interactions are analyzed and based on the comparison with the experimental results the best phenomenological anti$K$-nucleon interaction is selected.

We used the same antikaon-nucleon and nucleon-nucleon interactions to predict the deeply bound states and widths of four-body kaonic nuclei $K^-ppp$, $K^-ppn$, and $K^-pnn$ to stimulate outgoing search of kaonic nuclei at the different experimental facilities in USA, Europe and Japan. The results of our theoretical prediction within the microscopic approach will be done in the framework of the method of HH.