Nuclear $\bar{\mathrm{K}}$ bound states in proton-rich systems produced by (K^-, π^-) reaction via Λ^* doorways

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Recently we predicted the possible existence of nuclear bound states of $\bar{\mathrm{K}}$ in few-nucleon systems [1], where the strongly attractive $\mathrm{K}^-\mathrm{p}$ interaction plays an essential role.
We propose to use the (K^-, π^-) reaction to populate deeply bound $\bar{\mathrm{K}}$ states in proton-rich systems via $\Lambda(1405)$ and $\Lambda(1520)$ which serve as a "doorway" [2]. The advantage of this reaction is to produce very exotic $\bar{\mathrm{K}}$ bound systems on unbound nuclei, such as $\mathrm{K}^-\mathrm{pp}$, $\mathrm{K}^-\mathrm{ppp}$ and $\mathrm{K}^-\mathrm{pppn}$. The $\mathrm{K}^-\mathrm{pp}$ system is the lightest one, which can be called a *strange dibaryon*. The presence of a $\bar{\mathrm{K}}$ attracts two protons to form a bound state with $B = 48$ MeV and $\Gamma = 61$ MeV, the structure of which is shown in Fig. 1.
"Bound-$\bar{\mathrm{K}}$ nuclear spectroscopy" will provide a new paradigm in strangeness nuclear physics. When a K^- is injected into nuclear medium, high-density matter would be formed as a result of "contraction" due to the strong $\mathrm{K}^-\mathrm{p}$ attraction. Of particular interest is whether or not the K^- and surrounding nucleons keep their identities. It is vitally important to experimentally examine the simplest case of $\mathrm{K}^-\mathrm{pp}$, which is a gateway toward more exotic heavier strange systems.

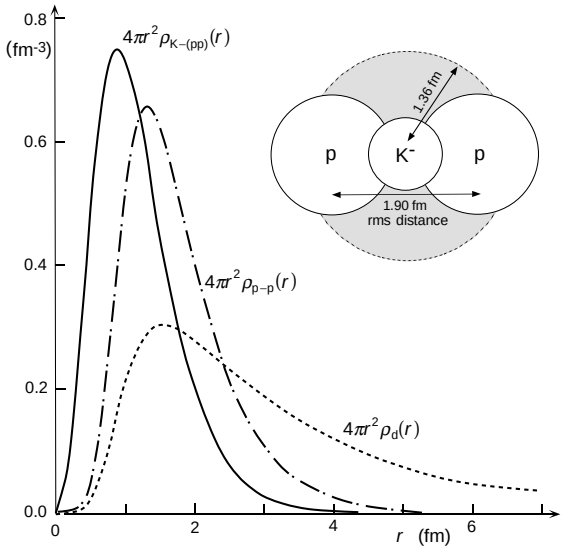

Figure 1: The K^- and proton density distributions in the $\mathrm{K}^-\mathrm{pp}$ system.

References

[1] Y. Akaishi and T. Yamazaki, Phys. Rev. C **65** (2002) 044005.
[2] T. Yamazaki, Nucl. Phys. **A691** (2001) 515c.
T. Yamazaki and Y. Akaishi, Phys. Lett. **B** (2002) .