Possible existence of Λ^* strangelets

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The Λ^*=$\Lambda(1405)$ plays an essential role in forming $\bar{K}$ nuclear clusters (KNC). A microscopic variational calculation shows that the simplest KNC, K^-pp, has the structure of $\Lambda^* - p = (K^-p) - p$, where a migrating anti-kaon between two nucleons produces "super-strong nuclear force" (SSNF) [1] by Heitler-London-Heisenberg's mechanism. Recent K^-pp data from DISTO [2] and J-PARC E27 [3] suggest that the SSNF attraction between Λ^* and p is largely enhanced inside the compact K^-pp. In the case of K^-K^-pp we can expect more than doubly enhanced attraction between two $\Lambda^*(K^-p)$'s. It is vitally important to obtain experimental information about K^-K^-pp by high-energy pp collisions around 7-GeV incident energy [4] in order to establish the covalent attraction due to multi-$\bar{K}$ migration. Since the boson ($\bar{K}$) covalency is always additive, we can predict the possible existence of several-body Λ^* strangelets including multi-$\bar{K}$'s, which could be stable against some strong decays. Relativistic heavy-ion reactions producing high-density objects may provide a chance to observe such strangelets where migrating multi-$\bar{K}$'s form, together with several neighboring nucleons, sufficiently long-lived clusters which consist of Λ^*'s. Such objects might open a way to Λ^* condensed matter.

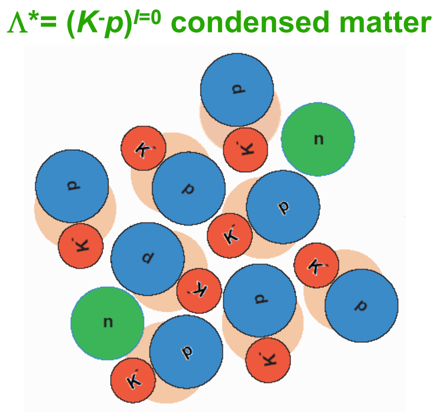

Figure 1: Schematic picture of Λ^* condensed matter, where K^- is confined in each Λ^* to avoid efficiently the K^-K^- repulsion.

References

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