

ROCKSTAR: Towards a Roadmap of the Crucial measurements of Key observables in Strangeness reactions for neutron sTARs equation of state

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Experimental study of the \bar{K} NNN state and beyond at J-PARC

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Kaonic nuclear states have been one of the hottest topics in hadron physics for these decades. After many experimental efforts, we finally found strong evidence of the \bar{K} NN state in the Λ_{pn} final state via in-flight K^- reaction on helium-3 in J-PARC E15. We are now constructing an upgraded solenoid spectrometer system to investigate kaonic nuclear systems further. One direction is systematically investigating heavier systems, such as \bar{K} NNN, \bar{K} -alpha, etc., which would lead to a more solid establishment of the kaonic nuclear states and to study the interplay between the \bar{K} N attraction, the NN repulsion, and other involving effects.

As for the \bar{K} NNN state, we can study it with a quite similar method in E15 by replacing the target with helium-4. We already had a chance to collect data with a helium-4 target as a feasibility test of a lifetime measurement of light hypernuclei (J-PARC T77). In a preliminary analysis, we successfully reconstructed hundreds of Λ_{dn} events and observed a structure below the \bar{K} NNN binding threshold in the Λ_{d} invariant mass spectrum. The same reaction will be measured in more detail with the new spectrometer as J-PARC E80.

In this contribution, we would like to present the latest results of the Λ_{dn} analysis described above and discuss future prospects for a more comprehensive investigation of the heavier kaonic nuclear systems.

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