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Studies of baryon-baryon interaction at J-PARC

Recent results and future plans at J-PARC on baryon-baryon interaction studies are presented.

We recently observed several new events of double-strange hypernuclei in the emulsion-counter hybrid experiment (E07) [1]. Observed events indicate a rather deep binding energy of Ξ in the ^{14}N nucleus. One of the events is interpreted as a bound state of Ξ in the nuclear 0s orbit, suggesting that the ΞN-$\Lambda\Lambda$ interaction is unexpectedly weak [2]. Further Ξ-hypernuclear studies by missing mass spectroscopy of the (K^-, K^+) reaction (E70) will be conducted soon.

We also successfully carried out a high-statistics $\Sigma^{\pm}$-p scattering experiment (E40) [3]. In the Σ^+p channel, the obtained cross section was converted to the phase shift, showing that the Σ^+p interaction has a much stronger repulsive core than the NN interaction, which is interpreted as a result of Pauli principle in the quark level [4].

In the future, we plan to investigate the ΛNN three-body force via high-resolution Λ-hypernuclear spectroscopy. Together with high quality Λ-p scattering experiments, it allows us to solve the "hyperon puzzle"in neutron stars. Such studies will be performed using new secondary beam lines in the J-PARC Hadron Facility extension project [5].

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