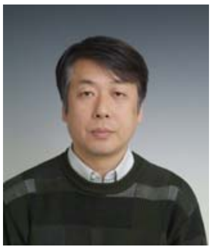
【Grant-in-Aid for Specially Promoted Research】

Science and Engineering (Mathematics/Physics)



Title of Project : High-resolution Spectroscopy of Many-Body systems with Multi-Strangeness

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Research Area : Particle/Nuclear/Cosmic Ray/Astro physics

Keyword : Nuclear physics (experiment)

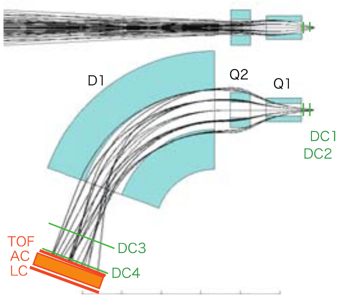
【Purpose and Background of the Research】

The spectroscopic information of both Ξ hypernuclei and double-Λ hypernuclei will give us information of ΞN interaction, ΛΛ interaction, and their coupling through the ΞN-ΛΛ channel. Such experimental information of baryon-baryon interaction with strangeness (S)= -2 is almost nothing at this moment. Nevertheless, several baryon-baryon interaction models have been theoretically developed. They put their basis on the so-called realistic nuclear force which reproduces a plenty of nucleon-nucleon scattering data, and extend it to the flavor SU(3) baryon-baryon interactions based on a traditional meson-exchange picture. The recent spectroscopic information of the S=-1 systems, such as Λ hypernuclei and Σ hypernuclei, gives an essential role to construct the baryon-baryon interaction models. Therefore, the experimental information on the strength of the central attraction of the ΞN interaction and its coupling strength in the ΞN-ΛΛ channel could be an important key to constrain the interaction models.

【Research Methods】

In this research, the (K^-,K^+) reaction spectroscopy is conducted for the first time by using the good energy resolution and large acceptance spectrometers together with the world-highest intensity K^- beam available at J-PARC.

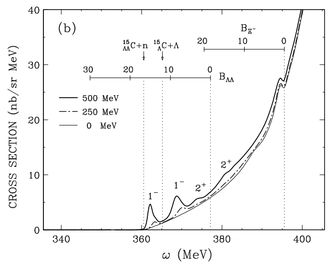
The new spectrometer is designed to have a momentum resolution of better than 0.05%(FWHM) and the solid-angle acceptance larger than 70 msr. The new spectrometer has a QQD configuration to have a better optical property.



It will become possible to measure the excited levels of double-Λ hypernuclei together with the bound states of Ξ hypernuclei in the (K^-,K^+) missing-mass spectra.

【Expected Research Achievements and Scientific Significance】

We will carry out the (K^-,K^+) spectroscopy to observe Ξ hypernuclei and double-Λ hypernuclei in a wide excitation energy range of ~40 MeV. The coupling between two types of hypernuclear bound states through the ΞN-ΛΛ affects the energy levels of both Ξ hypernuclei and double-Λ hypernuclei. With the new spectrometer system, we will measure the ^{16}O(K^-,K^+) reaction, first. Then, we will investigate the iso-spin dependence and mass-number dependence of the ΞN potentials by using ^{10}B, ^{7}Li and ^{28}Si targets.



【Publications Relevant to the Project】

- P. Khaustov, D.E. Alburger, et al., “Evidence of Ξ hypernuclear production in the ^{12}C(K^-,K^+)$^{12}{}_{\Xi}$Be reaction”, Phys. Rev. C 61 (2000) 054603
- T. Harada, Y. Hirabayashi, A. Umeya, “Production of doubly strange hypernuclei via Ξ- doorways in the ^{16}O(K^-,K^+) reaction at 1.8 GeV/c”, Phys. Lett. B 690 (2010) 363-368.

【Term of Project】 FY2011-2015

【Budget Allocation】 336, 200 Thousand Yen

【Homepage Address and Other Contact Information】

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