Exotic Nuclei with Double Strangeness in Nuclear Emulsion

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In the present article, the latest status of the study for double strangeness nuclei with nuclear emulsion techniques is presented. The J-PARC E07 experiment which investigates the double-strangeness nuclear system with the (K^-, K^+) reaction has been started at the Hadron Experimental Facility in Japan Proton Accelerator Research Complex (J-PARC). In the 1st physics run scheduled on 2016 June, $\simeq 20\%$ of the total number of emulsion sheets will be irradiated by the K^- beam. A new method, "overall scanning" with "vertex picker", has been developed to quickly scan tracks of interest in the whole volume of emulsion sheets. This method was applied to emulsion sheets used in the KEK-PS E373 experiment, and a candidate of a nuclear bound system of Ξ^--^{14}N was successfully observed.

1. Introduction

1.1 Double strangeness nuclei and baryon-baryon interaction

Double strangeness nuclei, such as double Λ hypernuclei and Ξ hypernuclei, as shown in Fig. 1, are important subjects to investigate $\Lambda\Lambda$ and ΞN interaction as to establish the unified understanding of baryon-baryon interaction. The mass measurement of double Λ hypernuclei and Ξ hypernuclei is an effective way to study the $\Lambda\Lambda$ and ΞN interaction, respectively.

One of the best detectors to investigate double strangeness nuclei is nuclear emulsion sheet, which is a photographic sheets to record the tracks of charged particles with the accuracy of sub-micro meters.
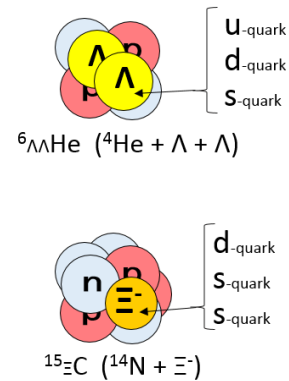

Fig. 1. Schematic illustrations of a double Λ hypernucleus $^{6}_{\Lambda\Lambda}$He and Ξ hypernucleus $^{15}_{\Xi}$C.