$\Lambda\Lambda$ interaction indicated by the ${}^{6}_{\Lambda\Lambda}$He from KEK-E373

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For the unified description of the baryon-baryon interaction on the $SU(3)_f$ symmetry, it is important to study the singlet 1_s sector of a doubly strange system, which is studied through only $S=-2$ nuclear system. If the interaction between two hyperons is attractive based on the calculation using the MIT bag model, the H-dibaryon proposed by R.L.Jaffe may exist. The nuclear system with $S=-2$ is also interesting, because it gives us information about hyperon mixing, *e.g.* $\Lambda\Lambda-\Xi N-\Sigma\Sigma$. Since the H state may appear in the above mixing, it will be expected for various nuclear states. However, experimental information about $\Lambda\Lambda$ interaction energy ($\Delta B_{\Lambda\Lambda}$) was quite limited and the $\Delta B_{\Lambda\Lambda}$ value has not been decided, yet. The main reason was that the expected number of Ξ^- stopping events in the past experiments was too small to fix the $\Delta B_{\Lambda\Lambda}$.

Therefore, the hybrid emulsion experiment E373 at KEK has been carried out to obtain Ξ^- stopping events with ten times more statistics than that of the previous E176, where the number of the events becomes 10^3. By the 10% data analysis of all, one twin single-Λ hypernuclei event and two events of double-Λ hypernucleus have been successfully detected. The twin single-Λ event was uniquely interpreted as $\Xi^- + {}^{14}\mathrm{N} \rightarrow {}^{5}_{\Lambda}\mathrm{He} + {}^{5}_{\Lambda}\mathrm{He} + {}^{4}\mathrm{He} + n$ for the first time. In the first double-Λ hypernucleus event, "*Demachi-Yanagi*", it was interpreted as $\Xi^- + {}^{12}\mathrm{C} \rightarrow {}^{10}_{\Lambda\Lambda}\mathrm{Be}$(or ${}^{10}_{\Lambda\Lambda}\mathrm{Be}^*$)$+t$, if two-body reaction was occurred at a Ξ^--^{12}C system.

The second double-Λ hypernucleus event, "*NAGARA*", has been detected with a clearly recognized topology, see below. The nuclide and its decay mode have been uniquely identified as; $\Xi^- + {}^{12}\mathrm{C} \rightarrow {}^{6}_{\Lambda\Lambda}\mathrm{He} + {}^{4}\mathrm{He} + t$, ${}^{6}_{\Lambda\Lambda}\mathrm{He} \rightarrow {}^{5}_{\Lambda}\mathrm{He} + \pi^- + p$, ${}^{5}_{\Lambda}\mathrm{He} \rightarrow p + d + 2n$ *etc.* By the preliminary result of the ${}^{6}_{\Lambda\Lambda}$He analyses, the attractive $\Lambda\Lambda$ interaction has been confirmed with the $\Delta B_{\Lambda\Lambda}$ $\sim$1 MeV, where its error is less than 0.5 MeV. In my talk, concluding information for the $\Delta B_{\Lambda\Lambda}$ by the event will be presented in comparison with the past experimental results.

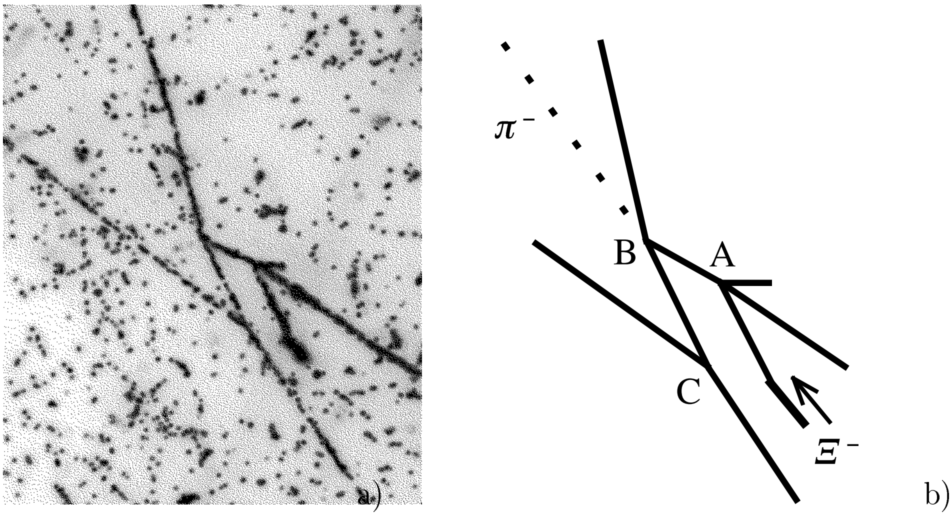

Figure a): An emulsion image of the second double-Λ hypernucleus "*NAGARA*" event, ${}^{6}_{\Lambda\Lambda}$He, by E373. b): A schematic drawing of the event. The ${}^{6}_{\Lambda\Lambda}$He is produced at point A and decay at point B. The event is named "*NAGARA*", which is a river originating in Gifu, Japan. The ranges of the double- and the single-Λ hypernucleus are 8.3 and 9.2 μm, respectively.

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