Contribution ID: **36** Type: **Plenary Contribution**

First observation of the heavy hyper-hydrogen isotope 6ΛH

Thursday, 13 October 2011 16:25 (25 minutes)

The replacement of a nucleon with a Λ hyperon leads to the production of Λ-hypernuclei. These strange systems are more stable than ordinary nuclei due to the compression of the nuclear core and to the addition of an extra binding energy from the Λ hyperon, which plays the so called "glue-like"role, being free from the Pauli blocking effect. In this respect, Λ-hypernuclei are better candidates than normal nuclei to exhibit large neutron excess and neutron halo phenomena. The study of hypernuclei with high N/Z values can give information on baryon-baryon interaction and on the behaviour of hyperons in a medium with a much lower density than for ordinary hypernuclei. Moreover the role of the three-body ΛNN force, related to the coherent Λ–Σ coupling, can be investigated.
Great interest exists for the possible existence of 6ΛH (N/Z=4). Theoretical calculations [1] predict the existence of a stable single-particle state with a binding energy of 5.8 MeV from the 5H + Λ threshold when the Σ–Λ coupling is considered, while without this term the state would be very close to the 4ΛH + 2n threshold, with a binding energy of 4.4 MeV, as initially predicted by Majling [2]. Production rates have not yet been evaluated theoretically.
Experimentally, 6ΛH can be produced by the two-step Double Charge Exchange (DCX) mechanism: K- + p –> Λ + π0; π0 + p –> n + π+ on a 6Li target. The experimental observation of the production of such a neutron-rich hypernucleus would be the most evident example of the glue-like role of the Λ hyperon, being the 5H core above the 3H+2n emission threshold.
The FINUDA experiment, dedicated to the study of spectroscopy and decay of Λ-hypernuclei produced by means of the (K-stop, π-) Strangeness Exchange reaction at DAΦNE, the INFN Frascati φ-factory, studied the production of 6ΛH: with a partial data sample an upper limit of (2.5+-0.4) 10-5/K-stop at 90% C.L. [3] was obtained by analyzing the DCX π+ momentum. Considering the final data sample of the experiment it is now possible to perform a more accurate identification of the production, by requiring the coincidence of the π- coming from the mesonic decay of the hypernucleus: three events have been observed which can be attributed to the 6ΛH hypernucleus production and decay. The hypernuclear mass evaluated from the events is ~5801.4 MeV/c2, which would indicate the absence of a significant Λ–Σ coupling term contribution. The production rate is actually under evaluation: the preliminary indication is of the order of 10-6/K-stop. This is the first observation of 6ΛH.

[1] Y. Akaishi, T. Yamazaki, Frascati Physics Series XVI (1999) 59.
K.S. Myint et al., Few-Body Sys. Suppl. A 12 (2000) 383.
[2] L. Majling, Nucl. Phys. A 585 (1995) 221c.
[3] M. Agnello et al., Phys. Lett. B 640 (2006) 145.

Primary author: Prof. BOTTA, Elena (Torino University and INFN-Sezione di Torino)

Presenter: Prof. BOTTA, Elena (Torino University and INFN-Sezione di Torino)

Session Classification: Nuclear Physics III

Track Classification: Nuclear Physics