



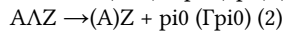
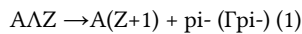
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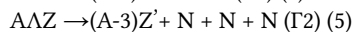
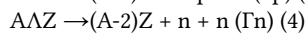
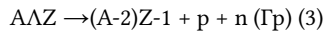
Weak decay of Lambda-hypernuclei

Thursday, October 13, 2011 3:30 PM (25 minutes)

The information coming from the study of the Lambda-hypernuclei weak decay channels complements the knowledge of strange nuclear systems obtained by both missing mass and gamma-ray spectroscopy measurements. Lambda-hypernuclei decay through both the mesonic weak decay (MWD) processes:



and the non-mesonic weak decay (NMWD) processes:



The channel (5) is indicated as two-nucleon induced (2N) decay and refers to the interaction of the Λ with a couple of strongly correlated nucleons; Z' stands for Z , $Z-1$ or $Z-2$ depending on the particular nucleons combination. The FINUDA experiment performed a complete analysis of the charged particles (π^- and p) spectra following the MWD and

NMWD of $5\Lambda\text{He}$, $7\Lambda\text{Li}$, $9\Lambda\text{Be}$, $11\Lambda\text{B}$, $12\Lambda\text{C}$, $13\Lambda\text{C}$, $15\Lambda\text{N}$ and $16\Lambda\text{O}$ hypernuclei.

MWD spectra and decay rates have been obtained for $7\Lambda\text{Li}$, $9\Lambda\text{Be}$, $11\Lambda\text{B}$ and $15\Lambda\text{N}$, for the first time and compared with previous measurements and calculations. The spin-parity assignment $J_p(15\Lambda\text{N g.s.}) = 3/2^+$ was made for the first time and the results have been published [1].

The FINUDA Collaboration also analyzed the proton energy spectra of $5\Lambda\text{He}$, $7\Lambda\text{Li}$, $9\Lambda\text{Be}$, $11\Lambda\text{B}$, $12\Lambda\text{C}$, $13\Lambda\text{C}$, $15\Lambda\text{N}$ and $16\Lambda\text{O}$ with good resolution ($\Delta p/p = 2\%$ FWHM for protons of 80 MeV) and with a detection threshold of 15 MeV. All measured spectra showed a similar behaviour, i.e. a bump at about 80 MeV, roughly at the energy expected from reaction

(3) (with an uncertainty of about 10 MeV due to several nuclear structure and interaction effects). The bump is quite well defined in the high energy portion, whereas at low energies it is blurred in a continuum generated by FSI, superimposed to the 2N-induced NMWD contribution. With very simple hypotheses and a model-independent method the contributions from FSI and 2N-induced NMWD were disentangled, providing a value of Γ_{2N}/Γ_p of 0.43 ± 0.25 and $\Gamma_{2N}/(\Gamma_{\text{NMWD}})$ of 0.24 ± 0.10 [2]. This method was recently improved with the further detection of a neutron, from which we determined the value of $\Gamma_{2N}/\Gamma_{\text{NMWD}}$ with an error reduced of a factor about two respect to the previous FINUDA determination [2]. In fact, in spite of the low statistics, we determined the value of $\Gamma_n/\Gamma_p = 0.39 \pm 0.16_{\text{stat}} + 0.04_{\text{sys}} - 0.03_{\text{sys}}$ and $\Gamma_{2N}/\Gamma_{\text{NMWD}} = 0.21 \pm 0.07_{\text{stat}} + 0.03_{\text{sys}} - 0.02_{\text{sys}}$. The value is in agreement, within the errors, with previous evaluations, model dependent or not, and with theoretical calculations [3].

References

- [1] M. Agnello et al., Phys. Lett. B 681 (2009) 139.
- [2] M. Agnello et al., Phys. Lett. B 685 (2010) 247.
- [3] M. Agnello et al., Phys. Lett. B (2011), doi:10.1016/j.physletb.2011.06.035

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