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Study of pionless two-nucleon K^- absorption at rest by FINUDA

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Data on two-nucleon K^- absorption in mesonless final states, $K^- + N + N \rightarrow YN$, are very scarce and dated. Most of the existing capture rates have been inferred indirectly from mononucleonic absorptions, and only results for ^4He , ^{12}C , Ne and CF_3Br exist, obtained by bubble chamber experiments [1]. The general understanding is that pionless two-nucleon K^- absorption could account for a fraction of all captures as large as 20%.

The knowledge of the capture rates of such reactions is important as they represent the major background source in hypernuclear studies, as the phase space for the decay particles from produced hyperons overlaps with the spectra of hypernuclear formation pions and of the hypernuclear non-mesonic decay products [2,3]. Especially in case of rare decays, these reactions could give an overwhelming contribution, difficult to be separated from the searched signals. So, the knowledge of their occurrence rate is fundamental for correct background estimations.

At the DAΦNE ϕ -factory kaons from the ϕ decays were stopped in the FINUDA experiment in a series of thin targets, to perform hypernuclear spectroscopy studies as well as investigations on kaon absorption mechanisms on single and many nucleons. The pionless absorption reactions $K^- A \rightarrow \Sigma^- pA'$ and $K^- A \rightarrow \Lambda(\Sigma^- 0)nA'$, occurring on a (np) pair embedded in the A nucleus, were studied for some p -shell nuclei, namely ^6Li , ^7Li , ^9Be , ^{13}C and ^{16}O . The Σ^- hyperons in the final states were reconstructed via their $n\pi^-$ decay mode, while the Λ 's by means of their charged decay, the charged pions and protons being detected and identified by the FINUDA magnetic spectrometer. Neutrons, on the other hand, were detected by a large scintillator array completing externally the apparatus, featuring an efficiency of $\sim 10\%$.

The emission rates for the mentioned reactions, as a function of the mass number A , were measured for the first time. In this presentation, they will be discussed and compared to the existing measurements and theoretical expectations, also in connection with the recent measurements of FINUDA of the analogous rates for single nucleon kaon absorptions, $K^-_{stop} A \rightarrow \Sigma^\pm \pi^\mp A'$ [4].

References

- [1] C. Vander Velde-Wilquet et al., Nuovo Cim. 39 (1977), 538, and references therein
- [2] FINUDA Collaboration, M. Agnello et al., Phys. Lett. B698 (2011), 219
- [3] FINUDA Collaboration, M. Agnello et al., Phys. Lett. B685 (2010) 247

[4] FINUDA Collaboration, M. Agnello et al., paper submitted to Phys. Lett. B (2011)

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