Contribution ID: **7** Type: **Presence talk**

A sackful of antineutrons: a wishlist for the solution of a few open problems

Tuesday 9 April 2024 15:30 (35 minutes)

Using antineutrons as probes has proved to be a smart way to achieve precise and high-quality results in nuclear and particles physics experiments, thanks to their unique features, complementary to those of antiprotons. In fact, being neutral particles, antineutrons are not subject to Coulomb scattering in a target; moreover, in the interaction with protons at rest pure I=1 eigenstates can be formed. The same situation can only be achieved with antiprotons if they interact on deuterons, but in this case the target nucleon is characterized by the Fermi motion so its momentum is hard to be precisely assessed.

From the technical point of view, producing antineutron beams with enough intensity and momentum resolution to perform dedicated experiments is not easy. Antineutron beams have been designed and put into operations since the early Eighties, as secondary beams produced following the annihilation of antiprotons, or the Charge-exchange (CEX) pbar p -> nbar n reaction. Only in the early Nineties a second-generation experiment at LEAR, OBELIX (PS201), was equipped with a section expressely conceived for the production of an antineutron beam through CEX. The produced beam could reach an intensity on the order of 100 nbars/s and a momentum, measured via Time-of-Flight, ranging continuously from ˜40 to about 400 MeV/c. A total of about 35 millions of antineutron annihilations on hydrogen and/or nuclear targets were collected, which allowed to perform unprecedented studies of the dynamics of the annihilation processes and to obtain the first meson spectroscopy results ever in reactions induced by antineutrons.

However, not all of the performed observations reached a thorough comprehension and a few issues were left open: from the role of different isospin sources in the annihilation process, to the possible existence of a long-searched below-threshold baryonium bound state, to spectroscopic studies of reactions with mesons featuring open and hidden strangeness. For this reason, a fresh set of precise measurements would be desireable.

In this talk a survey on the still existing open riddles in low-energy antiproton (and antinucleon at large) physics will be presented, with some ideas for possible measurements of interest at a new antiproton facility.

Author: Dr FILIPPI, Alessandra (INFN Torino (IT))

Presenter: Dr FILIPPI, Alessandra (INFN Torino (IT))

Track Classification: Nuclear and Hadronic Physics with antiprotons and antineutrons