Search for double-strangeness production in pbar-p annihilation at CERN/AD

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Weise [1] and Kienle [2] discussed recently the possibility to produce and study double-strange nuclei with stopped antiproton annihilation reaction on light nuclei, like:

$$p + pbar \rightarrow K^- + K^- + K^+ + K^+$$

The detection of two kaons in antiproton annihilation at rest in a nuclear target is an excellent signature to unravel the existence of such bound nuclear clusters, like:

$$pbar + {}^4He \rightarrow K^+ + K^+ + pnnK^-K^-$$

It would be very exciting to produce and study "double-strange nuclei" in view of the prediction of Akaishi and Yamazaki that double-antikaon bound nuclear systems with strangeness (S = -2) will be formed, with binding energies up to 400 MeV. Such binding energies might result in an increase of the average density to more than 3 times the average nuclear density. If such dense (S = -2) clusters are formed, conditions in the phase diagram might be reached where phase transition to kaon condensation or colour superconductivity occurs at low temperature.

A first hint that double-antikaon clusters were formed was found in a new analysis of the OBELIX data [3].

In the following, an experimental setup will be described to search for the existence of such exiting states using a gaseous helium target and a TPC with GEM readout. To perform the experiment at the CERN/AD will be an excellent choice, having slow pbar extraction made available by the Musashi trap.

References

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P.Kienle, Int. Jour. Mod. Phys. E16 (2007) 905.
[3] G.Bendiscioli et al., to be published in NPA (NPA-D-07-00114R1).