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Precision measurement of the mass-to-charge difference between light nuclei and anti-nuclei with ALICE at the LHC

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In ultrarelativistic heavy-ion collisions a large and equal amount of nuclei and anti-nuclei is produced in the central pseudorapidity region allowing for a precise investigation of their properties. Mass and binding energy are expected to be the same in nuclei and anti-nuclei as long as the CPT invariance holds for the nuclear force, a remnant of the underlying strong interaction between quarks and gluons.
Thanks to its excellent tracking and particle identification capabilities, the ALICE experiment allows the investigation of the produced (anti-)matter at the LHC. The measurements of the difference in mass-to-charge ratio between deuteron and anti-deuteron, and 3He and $3(\mathrm{He})^{-}$ nuclei performed with the ALICE detector is presented.
The precision of the measurement of the relative differences improve by one to two orders of magnitude compared with previous analogous direct measurements. Given the equivalence between mass and energy, the results improve by a factor two the constraints on CPT invariance inferred from (anti-)deuteron measurements. The binding energy difference has been determined for the first time in the case of (anti-)3He, with a precision comparable to the one obtained in the (anti-)deuteron state.
Perspectives of improved limits with a future larger data set expected in the next Pb-Pb run (November 2018) and during the LHC Run-3 will be also discussed.

Content of the contribution

Experiment

Author: NOFERINI, Francesco (Universita e INFN, Bologna (IT))

Presenter: NOFERINI, Francesco (Universita e INFN, Bologna (IT))

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