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(Anti)(hyper)nuclei and exotica measurements with the ALICE upgrade

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The expected increase in the integrated luminosity foreseen for the LHC Runs 3 and 4, combined with the performance of the upgraded ALICE detector, will allow for the measurement of the production of rare light-flavour probes such as (anti)nuclei and exotic states. Not only are these important probes of the system created in high-energy proton-proton (pp) and heavy-ion collisions, but also provide crucial information on the internal composite structure of these objects as well as on the properties of the QCD interaction among their constituents.
In order to distinguish between the coalescence and thermal-statistical production scenarios, the coalescence parameter will be measured for (anti)(hyper)nuclei that differ by mass, size and internal wave-function, as a function of the system size. Projections based on the integrated luminosity expected during Runs 3 and 4 will be presented. Runs 3 and 4 will open a precision era for measurements of light (anti)nuclei with mass number A = 2 and A = 3 and of the (anti)hypertriton in heavy-ion as well as in pp collisions. Measurements of the (anti)alpha particle will be performed with unprecedented precision and anti-hypernuclei with A = 4 will be in reach for discovery in Pb–Pb collisions.
In the exotic sector, $f_0(980)$ and N(1875) measurements will be feasible in Runs 3 and 4 and will shed light on the highly-debated nature of these states (hadrons or hadronic molecules). The study of possible dibaryon bound states as the $N\Omega$, $N\Xi$ and $N\Lambda_c$, via direct detection or baryon-baryon correlations, will be useful for hyperon-correlation studies, providing new insights into the baryon-baryon attractive potential as well as upper limits on the formation of such bound states in central heavy-ion collisions.
The impact of measurements of anti-nuclei and baryon-baryon correlations in small systems in the astrophysical domain, in indirect dark matter searches and neutron star physics, will also be discussed.

Collaboration name

ALICE Collaboration

Track

Upgrades and new experiments

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