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Production of fragile objects in high energy collisions at the LHC — •Benjamin Dönigus for the ALICE-Collaboration — Institut für Kernphysik, Goethe Universität Frankfurt

The high collision energies reached at the Large Hadron Collider (LHC) at CERN in proton-proton, proton-lead and, in particular, lead-lead collisions, lead to significant production rates of fragile objects, i.e. objects whose binding energies are small compared to the mean kinetic energy of the particles produced in the system. Such objects are, for instance, light (anti-)nuclei and (anti-)hypernuclei.

The most extreme example here is the hypertriton, a bound state of a proton, a neutron and a Λ, where the separation energy of the Λ is only around 130 keV. These states, from the anti-deuteron up to the anti-alpha nuclei, are nevertheless created and observed in heavy-ion collisions. Their production yields can even be well described in a statistical-thermal model approach with only three parameters, namely chemical freeze-out temperature T_{ch}, volume V and baryo-chemical potential μ_{B}. The latter is close to zero at LHC, which means the ratio of anti-baryons to baryons is close to unity and in continuation also anti-nuclei and nuclei are produced in equal amounts. T_{ch} at the LHC is extracted to be 156 MeV, which is a factor 1000 above the binding energy of the Λ to the deuteron, inside the hypertriton.

In addition, the thermal model can be used to make predictions for the production of other fragile objects, such as hyperon-nucleon or hyperon-hyperon bound states. The data collected at LHC can be used to test the existence of these bound states.