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Graduiertenkolleg 2149
Research Training Group

Allgemeines Physikalisches Kolloquium

Donnerstag, 17.12.2020 um 16 Uhr c.t.
Online-Kolloquium

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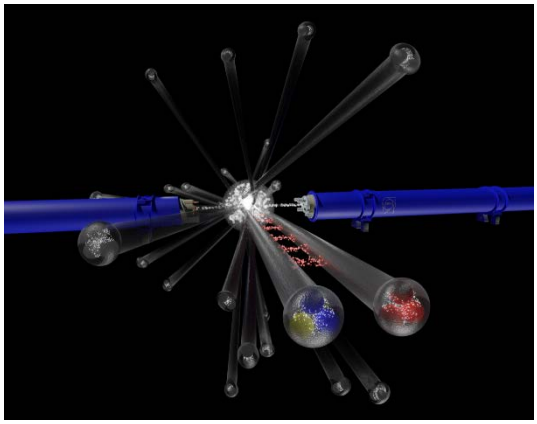
The ALICE experiment at the LHC opens a new avenue for nuclear physics



The study of the effective strong interaction among hadrons is one of the frontier of the standard model of nuclear and particle physics. Indeed, most of interactions among stable or unstable hadrons have not been measured yet and theoretical calculations starting from first principles, such as quarks and gluons, are mostly under development.
For stable nucleons, scattering experiments have been successfully employed in the past to measure two-body interactions and theoretical calculations based on chiral effective field theory are extremely successful in describing such interactions. First principle calculations on the other hand are still lacking.
For hyperon-nucleon pairs such as L-p, S-p, X-p the nature of the instable hyperon beams makes such measurements very difficult and consequently only scarce experimental data are available. Hyperon-hyperon interactions cannot be accessed at all with this technique.
These interactions are particularly interesting also because of their connection to the physics of neutron stars. Indeed, these strong interactions drive the equation of state (EoS) of dense neutron-rich matter with strange quark content and such EoS can be tested against the measurements of neutron star masses, radii and newly detected gravitational wave signals.
In this talk we show how p+p and p+Pb collisions measured by ALICE at the LHC have been exploited to study several, so far unkown, hyperon-nucleon and hyperon-hyperon interactions. Among others, we have observed for the first time the attractive pX- and pW- strong interactions. For both systems, first principle calculations based on gauge lattice models are available and could be tested for the first time. The pX- measurement is also relevant for the physics of neutron stars and the impact of the new results will be discussed.

We will demonstrate how these new measurements open a new era for hadron physics with the possibility of measuring in the future also three-body interactions for hyperons and nucleons and any stable or unstable hadron pairs.

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