Renaissance of Hadron-hadron Interaction Studies with ALICE at the LHC

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The study of the effective strong interaction among hadron pairs was pursued in the past via scattering experiments.

For hyperon-nucleon pairs such as Λαμβδα−νυχλεον, Σιγμα−νυχλεον the nature of the instable hyperon beams makes such measurements very difficult and consequently only scarce experimental data are available. Xi-nucleon, Omega-Nucleon and Hyperon-hyperon interactions can not be accessed at all with this technique.

This kind of interactions is particularly interesting because of its 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. Since one of the hypotheses about the unknown content of neutron stars is that neutrons and hyperons are contained in the core, a detailed knowledge of the interaction becomes mandatory to investigate this hypothesis in a quantitative way.

In this talk we show how p+p and p+Pb collisions measured by ALICE at the LHC can be exploited to study these hyperon-nucleon and hyperon-hyperon interactions with unprecedented precision. Among others, we have observed for the first time the attractive p-Ξ- and p-Omega- strong interactions. Implications for neutron stars will be discussed.

These correlation analyses open a new era for hadron physics with strangeness substituting scattering experiments.

This will provide us with precise constraints for the EoS of neutron-rich matter with hyperon content.