HK 58: Hadron Structure and Spectroscopy VII

Time: Thursday 14:00–15:30 Location: SCH/A419

Group Report HK 58.1 Thu 14:00 SCH/A419

Understanding the dynamics of three-body systems using femtoscopy at the LHC — •Raffaele Del Grande for the ALICE Germany-Collaboration — Technical University of Munich, Garching, Germany

Three-body forces among hadrons are necessary for the theoretical description of nuclear bound objects and for modeling the equation of state of neutron stars. Direct measurements of three-body interactions are currently missing and represent one of the current challenges for experimental nuclear physics. The ALICE Collaboration has recently extended the femtoscopy technique to explore the strong interaction in three-particle systems, exploiting both three-hadron and hadron-nucleus correlation studies. The present contribution provides an overview of the milestones reached by ALICE in the study of three-body systems, using the femtoscopy technique in pp collisions at $\sqrt{s} = 13$ TeV. The main highlights are the first experimental measurements of three-baryon correlations, p–p–p and p–p–Λ, and the first study of three-body systems with kaons, p–p–K^+ and p–p–K^-. The contribution of genuine three-body effects in the measured correlation functions has been isolated using Kubo's cumulant expansion method. The interpretation of such measurement and the possible implications on the equation of state of neutron stars and bound state formation will be discussed.

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HK 58.2 Thu 14:30 SCH/A419

Understanding the particle emitting source of π–π correlations from measurements in MB pp of ALICE at 13 TeV — •Maximilian Korwieser for the ALICE Germany-Collaboration — TU München, Physik Department E62, Excellence Cluster 'Universe', Garching

The ALICE collaboration recently published a plethora of results obtained from femtoscopic measurements, studying the interaction between many exotic combinations of particles, most notably Ω–p. In general these studies depend on a precise understanding of the particle emitting source, which is constructed employing the resonance source model (RSM). In the RSM, deviations of a Gaussians source distribution, due to the effects of short lived resonances, are modeled via a Monte Carlo procedure. For two particle correlations between baryons (p–p and Λ–p) the RSM was already validated with great success. The goal of this work is to validate whether the RSM can also be applied to constrain the source in the mesonic sector. A differential study of the source functions spatial extension is presented, in bins of m_{T} and multiplicity classes, by analysing MB pp collisions at $\sqrt{s} = 13$ TeV obtained by ALICE. An m_{T} scaling behaviour of the source is observed and found to be compatible with previous results in the baryonic sector. This measurement supports the scenario of a common source for mesons and baryons in small colliding systems, allowing to employ the RSM to constrain the source for meson–baryon and meson–meson.

This research was supported by the BmBf.

HK 58.3 Thu 14:45 SCH/A419

Investigating p–π^+ and p–π^- femtoscopic correlations with ALICE at the LHC — •Marcel Lesch for the ALICE Germany-Collaboration — TUM, James-Franck-Straße 1, 85748 Garching bei München

The modelling of neutron stars is deeply linked to the understanding of the nuclear equation of state (EoS). It was recently proposed that the QCD axion might impact the EoS of neutron stars and that its properties at large baryonic densities can be related to the in-medium properties of pions. Constraining the latter is thus crucial for the study of the QCD axion and its impact on the description of neutron stars. By employing recently developed three-body femtoscopic techniques, the in-medium properties of pions can be inferred from correlation measurements between pions and many nucleons in pp collisions at the LHC. These small systems produce particles at distances of ~ 1 fm, mimicking a large-density environment. However, to understand the experimental three-body correlations, the lower-order two-body correlations between p–π^+ and p–π^- must be constrained. In this talk, we present the first measurement of p–π^+ and p–π^- correlations using two-body femtoscopy. The results have been obtained by analysing high-multiplicity pp collisions at $\sqrt{s} = 13$ TeV measured by ALICE.

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HK 58.4 Thu 15:00 SCH/A419

ALICE determines the scattering parameters of open charm mesons with light-flavor hadrons — •Daniel Battistini for the ALICE Germany-Collaboration — Technical University of Munich, Munich, Germany

The strong interaction among D mesons and light-flavor hadrons was completely out of experimental reach until recently. The lack of experimental constraints on the scattering parameters of D-proton/pion/kaon poses strong limitations not only to the search of molecular states composed of charm and non-charm hadrons, but also to the study of the rescattering of charm mesons in the hadronic phase of ultrarelativistic heavy-ion collisions. The knowledge of the scattering parameters of charm hadrons with non-charm hadrons would be a crucial ingredient for models based on charm-quark transport in a hydrodynamically expanding QGP to describe the typical observables of heavy-ion collisions.

In this talk, we will report on the first measurement of the scattering parameters of open charm mesons with light-flavor hadrons. The study is carried out by the ALICE Collaboration, in high-multiplicity proton-proton collisions at $\sqrt{s} = 13$ TeV. The scattering parameters are measured employing correlation techniques and the final-state strong interaction is found to be shallow in all the channels under study.

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HK 58.5 Thu 15:15 SCH/A419

Studying the pΛ interaction in small collision systems using a common emission source — •Jaime Gonzalez and Dimitar Mihaylov — Technical Unverisity of Munich

This work introduces a new framework (CECA) to model the source function that represents the spatial and kinematic properties of a particle emission in small collision systems. The properties of the source have been fixed within CECA by using an existing ALICE measurement of the pp source size in pp collisions. Under the assumption of a common source, a simulation of the kinematic properties of the pΛ system is performed and compared to existing measurements. Utilizing several parameterizations of the chiral effective field theory, used to model the pΛ interaction, allowed to study the properties of the hyperon-nucleon interaction, which is an important ingredient for the nuclear Equation of State and the modeling of the structure of neutron stars. Funded by BMBF Verbundforschung (05P21WOCA1 ALICE).