HK 30: Hadron Structure and Spectroscopy VI

Time: Thursday 13:45–15:45 Location: PHIL A 401

Group Report HK 30.1 Thu 13:45 PHIL A 401

Inclusive measurement of R — Thomas Lenz, •Weiping Wang, and Achim Denig for the BESIII-Collaboration — Johannes Gutenberg-Universität Mainz, Germany

The inclusive measurement of R, which is the ratio of the leading-order cross sections between inclusive hadronic events and a pair of muon leptons, is of great importance in the precision test of the Standard Model. For example, the determination of quantum electrodynamics running coupling constant at the Z pole, the evaluation of the anomalous magnetic moment of muon, and search and study of exotic hadron states. In this presentation, we will introduce the inclusive measurement of R at BESIII, including the published results and ongoing efforts based on the conventional energy-scan method. In addition, we will present a novel approach for R measurement that combines the advantages of the initial-state radiation technique with the inclusive method. This approach enables an inclusive determination of R over the energy range from 0.3 to 2.0 GeV, which is of significant interest to the community.

Group Report HK 30.2 Thu 14:15 PHIL A 401

Experimental input to HVP from the BESIII collaboration — •Riccardo Aliberti, Achim Denig, Christoph Redmer, and Weiping Wang for the BESIII-Collaboration — JGU Mainz

The time-like pion (vector) Form Factor (FF), i.e. the cross section for the process $e^+e^- \to \pi^+\pi^-$, is the most important input to the dispersive evaluation of the Hadronic Vacuum Polarization (HVP) contribution to the anomalous magnetic moment of the muon a_μ. Decades of pion FF, and in general hadronic cross section, measurements have allowed the muon g-2 theory initiative to publish in 2020 a SM prediction for a_μ with sub-percent accuracy on the HVP contribution. This value is in strong tension (more than 5σ) with the latest experimental results reported by the muon g-2 collaboration. Despite such a tension would be a clear sign of new Physics, recent ab-initio calculations of HVP from lattice QCD have reached an accuracy competitive with the dispersive approach and their results lead to a SM value for a_μ, which is well in agreement with the direct measurements. At the same time, a new measurement of the pion FF by the CMD-3 collaboration shows a systematical deviation from previous results which would cover the discrepancy between the dispersive evaluation of HVP and the results from lattice QCD. In this talk, we will present the experimental efforts on going within the BESIII collaboration to provide new inputs to the dispersive evaluation of HVP with particular emphasis on a new high-precision measurement of the pion FF.

HK 30.3 Thu 14:45 PHIL A 401

Amplitude Analysis of the decay $\Lambda_b^0 \to \Lambda_c^+ \bar{D}^0 K^-$ — •Ellinor Eckstein, Kai Sebastian Habermann, and Sebastian Neubert — Helmholtz-Institut für Strahlen- und Kernphysik, Bonn

Understanding the internal structure of exotic hadrons remains one of the central challenges in hadron physics over the past two decades. Many of these unconventional states have been observed in decays of b-flavored hadrons, which are produced in large quantities at the LHCb experiment located at the LHC. A precise description of such decay processes requires a detailed modelling of the various resonant contributions that arise in hadronic two-body subsystems. The full decay amplitude must account for all relevant decay topologies as well as the interference between overlapping resonances.

In this talk, I will present the first amplitude analysis of the decay $\Lambda_b^0 \to \Lambda_c^+ \bar{D}^0 K^-$, observed with the LHCb experiment. The decay channel is dominated by D_s resonances in the intermediate state decaying to $\bar{D}^0 K^-$ and also recieves contributions from Ξ_c resonances in the $\Lambda_c^+ K^-$ subsystem. Particularly interesting is the $\Lambda_c^+ \bar{D}^0$ subsystem, because it consists of the same valence quark content as the well established pentaquark states observed in the $J/\psi p$ system of the decay $\Lambda_b^0 \to J/\psi p K^-$. Studying the possible coupling of these pentaquark states to the $\Lambda_c^+ \bar{D}^0$ system offers a new avenue to probe their internal structure and gain deeper insight into the nature of exotic hadrons.

HK 30.4 Thu 15:00 PHIL A 401

First measurement of the K^*–K_S^0 correlation function in pp collisions at ALICE in Run 3 — •Nils Konert for the ALICE Germany-Collaboration — James-Franck-Straße 1, 85748 Garching b. München

The recent discovery of the T_{cc^+} by LHCb, together with the growing number of unconventional hadronic states, has highlighted clear tensions with the traditional valence-quark picture. Several resonances do not fit naturally into the expected $q\bar{q}$ spectrum. Among them, the $f_1(1420)$ and $f_1(1510)$ have been discussed as potential tetraquark candidates, although their internal structure remains unsettled.

Femtoscopy provides a powerful tool to probe such questions. By measuring correlations between two decay products, femtoscopic techniques are sensitive to the underlying hadron-hadron interaction, and therefore to possible structural differences of the parent resonance. Both $f_1(1420)$ and $f_1(1510)$ decay into K^* and K_S^0, making this pair a promising system for investigating exotic configurations.

This contribution presents the first measurement of the K^*–K_S^0 correlation function using data collected by the ALICE experiment in pp collisions at $\sqrt{s} = 13.6$ TeV during LHC Run 3. The unprecedented statistics of Run 3 enable a significantly improved sensitivity to the interaction dynamics of this system, offering new insight into the possible exotic nature of the associated axial-vector states.

This project has been funded by the DFG under Germany's Excellence Strategy - EXC2094 - 390783311 and by BMFTR Verbundforschung (05P24WO4 ALICE).

HK 30.5 Thu 15:15 PHIL A 401

First measurement of the Λ–ϕ correlation function with data taken by ALICE in Run 3 — •Christopher Klumm for the ALICE Germany-Collaboration — James-Franck-Straße 1, 85748 Garching b. München

Neutron stars are among the densest objects in the observable universe and play a crucial role in advancing our understanding of dense hadronic matter. One of the central open questions is the so-called hyperon puzzle. In general, the relationship between the mass and radius of a neutron star is determined by its equation of state (EoS). Due to the extreme densities and pressures in the stellar core, the conversion of neutrons into hyperons is expected. However, this conversion leads to a softening of the EoS, preventing it from reproducing astrophysical observations. To counteract this effect, repulsive contributions to the hyperon–hyperon interaction are required. One proposed mechanism is the exchange of ϕ mesons between Λ hyperons, which could produce such a repulsion. With the transition to Run 3 of the LHC, the ALICE detector now benefits from a substantial increase in luminosity and statistics, enabling new insight into the baryon–baryon interaction using the femtoscopic method. Leveraging these improved capabilities, this contribution presents the first measurements of the two-body correlation between Λ and ϕ particles, using data collected by the ALICE experiment in pp collisions at $\sqrt{s} = 13.6$ TeV during Run 3 of the LHC. This project has been funded by the DFG under Germany*s Excellence Strategy - EXC2094 - 390783311 and by BMFTR Verbundforschung (05P24WO4 ALICE).

HK 30.6 Thu 15:30 PHIL A 401

Track Reconstruction Performance Studies of Electrons at the BESIII Experiment — •Silas Benedikt Debus, Achim Denig, and Christoph Florian Redmer — Institut für Kernphysik, Johannes Gutenberg-Universität Mainz

The investigation of hadron production in two-photon collisions at e^+e^- colliders is essential to provide further input to the data-driven calculations of the hadronic Light-by-Light (HLbL) contribution to the anomalous magnetic moment of the muon a_μ. In order to provide reliable information as a function of the momentum transfer, excellent knowledge of the tracking efficiency of the scattered electrons is mandatory.

The BESIII experiment, located at the Institute of High Energy Physics in Beijing, China, has collected more than $20\,\mathrm{fb}^{-}1$ of e^+e^- collision data at a center-of-mass energy of 3.773 GeV, which is perfectly suited to study two-photon reactions at momentum transfers of $\mathcal{O}(1\,\mathrm{GeV}^2)$. Since these processes predominantly occur at small scattering angles, we report in this presentation a combined study of track reconstruction and particle identification efficiencies for electrons in the relevant angular region of the BESIII detector, using the process $e^+e^- \to e^+e^-\gamma$ as reference reaction. — Supported by DFG FOR5327