HK 29: Hadron Structure and Spectroscopy V

Time: Thursday 13:45–15:30 Location: PHIL C 301

Group Report HK 29.1 Thu 13:45 PHIL C 301

Measurement of the cross section for $\gamma p \to \phi\pi^+\pi^- p$ and search for the $Y(2175)$ in photoproduction with the GlueX experiment — •Klaus Götzen[1] and Frank Nerling[1,2] for the GlueX-Collaboration — [1]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany — [2]Goethe-Universität Frankfurt, Germany

The $Y(2175)$, recently renamed to $\phi(2170)$, is discussed to be a strange partner state of the famous charmonium-like exotic vector state $Y(4260)$. The former has originally been observed in initial-state radiation by the BaBar experiment in 2006. Meanwhile, it has been reported in different e^+e^- annihilation experiments. Based on the first measurement of the differential cross section for the exclusive reaction $\gamma + p \to \phi(1020)\pi^+\pi^- p$, we have performed a search for this strangeonium-like exotic candidate $\phi(2170) \to \phi\pi^+\pi^-$ in the GlueX data [1]. It is addressed here for the first time in a photoproduction experiment. We do not find evidence for this state at the resonance parameters quoted by the Particle Data Group and provide upper limits on the photoproduction cross section. Instead, we find a structure at a mass of $m(\phi\pi^+\pi^-) = 2.24\,\text{GeV}/c^2$ with a statistical significance of about $5\,\sigma$. The parameters of this structure differ from those quoted by the Particle Data Group for the $\phi(2170)$ and are consistent with a previous observation in e^+e^- annihilation. In addition, there is evidence for a second structure at $1.82\,\text{GeV}/c^2$.

[1] GlueX Collab., subm. to PRL, Dec 2025; arXiv:2512.04136 [hep-ex]

HK 29.2 Thu 14:15 PHIL C 301

Weak Decay of Ω^--Dibaryons — •Emili Hill, Ishfaq Ahmad Rather, and Jürgen Schaffner-Bielich — Goethe Universität, Frankfurt am Main, Germany

We study the weak decay of Ω^- dibaryons within SU(3) flavor symmetry and chiral perturbation theory. These exotic states, carrying strange quarks, are relevant for understanding hyperon-hyperon interactions in dense neutron star matter. We examine mesonic and non-mesonic decay modes of the $\Omega^-\Xi^-$ and $\Omega^-\Xi^0$ systems using a pole-model framework. The decay pattern shows a strong sensitivity to the binding energy ϵ. For small values of the binding energy, mesonic decays dominate and the behavior resembles the decay of a free hyperon. As ϵ increases, non-mesonic channels overtake the mesonic ones. The crossover appears near $\epsilon \approx 2.7\,\text{MeV}$ for $\Omega^-\Xi^-$ and $\epsilon \approx 3.8\,\text{MeV}$ for $\Omega^-\Xi^0$.
These results identify the non-mesonic modes as promising channels for future searches. The study also points to the need for improved theoretical input, especially for the maximally strange $\Omega^-\Omega^-$ system, to understand its possible impact on neutron stars and heavy-ion collisions.

HK 29.3 Thu 14:30 PHIL C 301

Search for the spin-exotic $\pi_1(1600)$ in a three-pion system with GlueX data — •Ilia Belov and Farah Afzal for the GlueX-Collaboration — Institut für Experimentalphysik I, Ruhr-Universität Bochum, 44801 Bochum, Germany

The GlueX experiment in Hall D at Jefferson Lab is designed for studies of the light meson spectrum with an emphasis on searches for hybrid mesons that have exotic quantum numbers and therefore cannot be classified as conventional hadrons. The experimental facility exploits a linearly polarized tagged photon beam in the energy range from 8.2 to 8.8 GeV. The photon beam is incident on a liquid hydrogen fixed target. The detector setup consists of a spectrometer with a nearly 4π angular coverage, which has excellent capabilities for reconstruction of charged particle tracks, reconstruction of electromagnetic showers, and charged particle identification. Advanced searches for spin-exotic mesons are performed through the application of Partial Wave Analysis techniques.

The $\pi_1(1600)$ hadron with 1^{-+} quantum numbers is predicted to have a considerable decay width to a three-pion system. In this talk, I present studies towards a Partial Wave Analysis of the $\pi^+\pi^-\pi^-$ system produced in the $\gamma\, p \to \pi^+\pi^-\pi^-\Delta^{++}(\to p\pi^+)$ reaction with a polarized beam.

HK 29.4 Thu 14:45 PHIL C 301

Search for Y state in $e^+e^- \to \gamma\eta_c$ at BESIII — •Yu Gang[1,2], Klaus Götzen[1], Frank Nerling[1,2], and Klaus Peters[1,2] — [1]GSI, Darmstadt — [2]Goethe Universität Frankfurt

The BESIII experiment is operating since 2008 and it is well suited for charmonium spectroscopy. Since 2003, dozens of charmonium-like states have been discovered in experiment, however, their properties do not match the prediction of the charmonium quark model and the nature of these so-called XYZ states is still unknown. The most famous vector charmonium-like state $Y(4260)$ has been discussed to be a hybrid or a tetra-quark state. In a hybrid meson, the extra gluonic degree of freedom allows for an $M1$ transition without spin-flip, the partial decay width $\Gamma(Y_{hyb} \to \gamma\eta_c)$ is considerably larger than conventional vector-to-pseudoscalar transition. In phenomenology, the cross sections of exclusive $\gamma\eta_c$ production up to NNLO in electron-positron collision with center-of-mass energy ($\sqrt{s}$) from 4.0 to 5.5 GeV has been predicted. The NNLO result prefers the enhancement in $e^+e^- \to \gamma\eta_c$ for center-of-mass energies between $\sqrt{s} = 4.23$ GeV and 4.36 GeV, originating from decays of the exotic particle candidate $Y(4260)$.

Preliminary results of the energy dependent cross section measurement of $e^+e^- \to \gamma\eta_c$ to search for $Y \to \gamma\eta_c$ decays is presented.

HK 29.5 Thu 15:00 PHIL C 301

Femtoscopic study of the proton-proton and proton-deuteron systems in heavy-ion collisions at the LHC — •Wioleta Rzesa for the ALICE Germany-Collaboration — Technische Universität München, München, Germany

This work presents femtoscopic correlations of proton−proton (p−p) and proton−deuteron (p−d) pairs measured in Pb−Pb collisions at a center-of-mass energy of $\sqrt{s_{\text{NN}}} = 5.02$ TeV by the ALICE Collaboration. The p−p correlation functions allow the extraction of a precise power-law dependence of the nucleon femtoscopic radius on the pair transverse mass (m_{T}), as well as a linear dependence on the average charged-particle multiplicity. These dependencies are studied across three centrality intervals (0−10%, 10−30%, 30−50%) of Pb−Pb collisions. The measured p−d correlations are well described by both two-body and three-body calculations. This indicates that the femtoscopic observable in Pb−Pb collisions is not sensitive to short-distance features of the p−(p−n) interaction, owing to the relatively large interparticle distances created in the heavy-ion environment at the LHC. Moreover, the proton m_{T}-scaling obtained for the p−p and p−d systems is compatible within one standard deviation of the experimental uncertainties. These findings provide new input for fundamental studies of the production and behavior of light (anti)nuclei under extreme conditions.

HK 29.6 Thu 15:15 PHIL C 301

Selection and Resonant Structures in Semileptonic $B \to D\pi\mu\nu$ Decays at LHCb — •Piet Nogga and Sebastian Neubert — University of Bonn

Semileptonic B decays provide a powerful environment to study the strong interaction, as the hadronic system is produced in isolation from the leptonic system. This offers a clean setting for investigating hadronic resonances, free from interference with the leptonic part of the decay. However, the presence of an undetected neutrino makes the reconstruction of these decays experimentally challenging and introduces substantial background contamination.

The LHCb experiment records large and high-quality samples of B mesons, making it an excellent environment to study such semileptonic processes. This talk presents the analysis of the decay $B \to D\pi\mu\nu$, with a focus on the development and optimization of the selection processes required to reconstruct this challenging final state. A combination of simulation and data-driven processes is necessary to maximize signal purity, and the talk will cover the corresponding selection strategy. These optimizations allow us to investigate the hadronic system in detail, including possible intermediate resonances and their potential molecular nature.