

HK 38: Hadron Structure and Spectroscopy VIII

Time: Thursday 16:15–18:00

Location: PHIL A 401

Group Report

HK 38.1 Thu 16:15 PHIL A 401

Studies of $\Lambda(1405)$ photoproduction at BGOOD — •ANTONIO JOAO CLARA FIGUEIREDO for the BGOOD-Collaboration — Physikalisches Institut, Universität Bonn

The $\Lambda(1405)$ has long been considered a prime candidate for an unconventional hadronic state, with strong evidence supporting a dynamically generated meson-baryon molecular structure. To clarify the nature of the $\Lambda(1405)$, precise measurements of its line shape and differential production cross sections are essential.

The BGOOD experiment at the ELSA facility provides an ideal environment for the investigation of $\Lambda(1405)$ photoproduction at low momentum transfer. BGOOD combines a central electromagnetic calorimeter for neutral meson reconstruction with a forward magnetic spectrometer for charged particle identification, enabling access to very low momentum transfer kinematics which may be sensitive to molecular production mechanisms.

I will report on the current status of the $\Lambda(1405)$ investigation at BGOOD in the photoproduction reaction $\gamma p \rightarrow K^+ \Lambda(1405)$. Measurements of line shapes and differential cross sections will be presented, with particular emphasis on the $\Sigma^0 \pi^0$ decay channel and ongoing studies of the predicted two-pole structure of the $\Lambda(1405)$.

HK 38.2 Thu 16:45 PHIL A 401

η' beam asymmetry at threshold using the BGOOD experiment — •LEONI LUTTER for the BGOOD-Collaboration — Physikalisches Institut

The unexpected nodal structure of the beam asymmetry reported by the GRAAL collaboration in η' photoproduction very close to threshold could be explained by a previously unobserved very narrow resonance. BGOOD is one of the few experiments worldwide which is able to verify this result. The experiment is composed of a central calorimeter for neutral meson decays and a forward spectrometer for charged particle identification. Close to threshold the $\gamma p \rightarrow \eta' p$ reaction can be reconstructed over all centre-of-mass angles from proton identification at forward angles. A linearly polarised photon beam produced via coherent bremsstrahlung off a diamond radiator makes it possible to measure the η' beam asymmetry. Preliminary results of the $\gamma p \rightarrow \eta' p$ beam asymmetry will be presented.

HK 38.3 Thu 17:00 PHIL A 401

Investigation of the reaction $pp \rightarrow ppK^+K^-$ at 4.5 GeV with HADES detector — •VALENTIN KLAODOV^{1,2}, JOHAN MESSCHENDORP², and JAMES RITMAN^{1,2,3} for the HADES-Collaboration — ¹Ruhr-Universität Bochum, Bochum, Germany — ²GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany — ³Forschungszentrum Jülich GmbH, Jülich, Germany

This study presents an exclusive analysis of the $pp \rightarrow ppK^+K^-$ reaction using data collected with the HADES detector with a 4.5 GeV proton beam. The event selection is based on a neural-network particle identification employing a domain-adversarial approach. Together with a kinematic refit imposing four-momentum conservation, the purity of the final sample reaches $S/B \approx 30$. Clear contributions from $\phi(1020) \rightarrow K^+ K^-$ and $\Lambda(1520) \rightarrow p K^-$ are observed, with masses and widths consistent with the PDG data. S-wave final-state interactions are investigated by extracting the $p K^-$ and $K^+ K^-$ scattering-length parameters. This talk focuses on the particle identification performance studies, systematic uncertainties, and several new results, including improved angular analysis for the spin alignment of the $\phi(1020)$ resonance and a coupled-channel analysis of $\Lambda(1405) \rightarrow \Sigma^0 \pi^0 / p K^-$ decays.

HK 38.4 Thu 17:15 PHIL A 401

Feasibility Studies for hidden-charm Pentaquark searches with CBM — •RALF KLIEMT for the CBM-Collaboration — Ruhr-Universität Bochum, Bochum, Germany — GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, Germany

We investigate the feasibility to measure the direct production of pentaquark-like states at the CBM experiment at FAIR in proton-proton collisions. For these, we performed feasibility studies by evaluating the performance assuming the three LHCb-discovered pentaquark states. Using GEANT4-based simulations we analyzed the reaction to ppJ/ψ in the e^+e^- decay channel of the J/ψ at a beam energy of 29 GeV. The study demonstrates CBM's excellent capabilities with an invariant mass resolution for the pJ/ψ system below 7 MeV/c^2 and signal acceptance \times efficiency exceeding 10% whilst reducing background by $\mathcal{O}(10^{-9})$. Our results confirm CBM can provide high-precision measurements of pentaquarklike state properties through an independent production mechanism, offering crucial complementary data to the inclusive measurements and significantly advancing understanding of exotic hadronic states.

HK 38.5 Thu 17:30 PHIL A 401

Study of exclusive η meson production in proton-proton collisions with the HADES spectrometer — •SZYMON TRELIŃSKI^{1,2}, JAMES RITMAN^{2,3,4}, and IZABELA CIEPAL¹ for the HADES-Collaboration — ¹IFJ PAN Krakow — ²Ruhr-Universität Bochum — ³GSI Helmholtzzentrum — ⁴Forschungszentrum Jülich

Proton-proton collisions at a center-of-mass energy of 3.46 GeV, measured in February 2022 with the HADES detector at GSI, provide great opportunity to study exclusive η meson production. This energy lies in the transition region between near-threshold energies, described by effective Lagrangian models, and the soft regime, where Regge phenomenology is applied. Measurements in this range help to bridge these descriptions and contribute to a more coherent understanding of nonperturbative QCD dynamics.

The analysis focuses on the exclusive reaction $pp \rightarrow pp\eta \rightarrow pp\pi^+\pi^-\pi^0$, with the η reconstructed in its $\pi^+\pi^-\pi^0$ decay channel. This channel provides high statistics due to its large branching ratio combined with good reconstruction efficiency. The study considers different event topologies to extend the accessible phase space.

The talk will present the event selection strategy, the application of the kinematic fit, the background subtraction procedure, and the multidimensional unfolding technique, together with early-stage results on the total and differential cross sections for exclusive η production.

HK 38.6 Thu 17:45 PHIL A 401

Recent Measurements of the $\Lambda(1670)$ Differential Cross Section At the BGOOD Experiment — •DAVID KOWALK and THOMAS JUDE for the BGOOD-Collaboration — Physikalisches Institut, Universität Bonn

The lighter $\Lambda(1405)$ resonance is commonly interpreted as a $\bar{K}N$ bound state. It is therefore to be investigated if the heavier $\Lambda(1670)$ may also exhibit this molecular structure. Forward angle K^+ identification is therefore essential. The BGOOD photoproduction experiment is ideal for these studies. It consists of a central calorimeter, ideal for the identification of hyperon decays, and a forward spectrometer for K^+ identification. I will present preliminary measurements of the $K^+ \Lambda(1670)$ photoproduction differential cross section, identified via different $\Lambda(1670)$ decay modes.