HK 9: Hadron Structure and Spectroscopy 2

Time: Monday 14:30–16:30 Location: T/SR25

Group Report HK 9.1 Mon 14:30 T/SR25

Partial Wave Analyses of Antiproton-Proton Annihilations in Flight — •Julian Pychy, Helmut Koch, Bertram Kopf, and Ulrich Wiedner — Institut für Experimentalphysik I, Ruhr-Universität Bochum

To investigate important aspects for the upcoming $\overline{\mathrm{P}}$ANDA experiment, partial wave analyses (PWA) of $\overline{\mathrm{p}}$p-annihilation processes are carried out using data from the Crystal Barrel (LEAR) experiment. A coupled channel analysis of the three reactions resulting in the final states $\mathrm{K^+K^-}\pi^0$, $\pi^0\pi^0\eta$ and $\pi^0\eta\eta$ at a beam momentum of 900 MeV/c is currently in progress. Preliminary results on the determination of resonance contributions and of the spin density matrix (SDM) of different light mesons are presented. The elements of the SDM provide important information about the production process. Furthermore, results of the analyses of the channels $\omega\pi^0$, $\omega\pi^0\eta$ and $\pi^+\pi^-\pi^0\pi^0$ are discussed. These studies are focused on the determination of the contributing angular momenta of the $\overline{\mathrm{p}}$p-system as well as of the SDM of the ω meson. Significant spin-alignment effects depending on the production angle are visible here. These results are compared with those for the $\phi(1020)$ in the $\mathrm{K^+K^-}\pi^0$ channel. All analyses have been performed using PAWIAN, a common, object-oriented and easy-to-use PWA software that is being developed at the Ruhr-Universität Bochum.
This presentation summarizes recent activities of the Crystal Barrel (LEAR) Collaboration.
Supported by the BMBF.

Group Report HK 9.2 Mon 15:00 T/SR25

The BGO-OD experiment: status — •Jürgen Hannappel for the BGO-OD-Collaboration — Physikalisches Institut der Universität Bonn

In the framework of an international collaboration a new detector is set up at the accelerator facility ELSA in Bonn, the BGO-OD experiment.

It aims at systematic investigation of nonstrange and strange meson photoproduction, in particular t-channel processes at low momentum transfer. The setup uniquely combines a central almost 4π acceptance BGO crystal calorimeter with a large aperture forward magnetic spectrometer providing good detection of both neutral and charged particles, complementary to other setups like CB, LEPS or CLAS.

An overview of the BGO-OD detector is presented. Preliminary data from the first data takings will be shown and discussed.

This work is supported by DFG (SFB/TR-16).

HK 9.3 Mon 15:30 T/SR25

Constraint analysis for the interaction of the vector-meson octet with the baryon octet in effective field theory — Ayse Kücükarslan[1], Stefan Scherer[2], and •Yasemin Ünal[2] — [1]Canakkale Onsekiz Mart University, Canakkale, Turkey — [2]Institut für Kernphysik, JGU, Mainz

We investigate the interaction of the vector-meson octet with the baryon octet in a derivative expansion. At leading order, SU(3) symmetry allows for two independent couplings G_F and G_D proportional to the f and d symbols of SU(3). The vector-meson Lagrangian is given by a massive Yang-Mills theory with coupling constant g. Using a Dirac constraint analysis, we show that the interaction is consistent at the classical level, leading to no relation among the three coupling constants. In the next step, we consider the three- and four-point functions VVV and $VVVV$ at the one-loop level. By demanding renormalizability in the sense of effective field theory, i.e., all ultraviolet divergences can be canceled in terms of the most general effective Lagrangian, we obtain the universality relations $G_F = g$ and $G_D = 0$ for the renormalized coupling constants.

HK 9.4 Mon 15:45 T/SR25

Strangeness photoproduction at the BGO-OD experiment — •Thomas Jude for the BGO-OD-Collaboration — Physikalisches Institut, Universität Bonn, Nussallee 12, Bonn

The BGO-OD experiment at the ELSA accelerator facility uses an energy tagged bremstrahlung photon beam to investigate the internal structure of the nucleon. The setup consists of a highly segmented BGO calorimeter surrounding the target, with a particle tracking magnetic spectrometer at forward angles.

The BGO-OD is ideal for investigating the photoproduction of hadrons of non-zero strangeness. The high momentum resolution at forward angles covers a kinematic region where t-channel exchange mechanisms play a dominant role. This is complemented by the neutral and charged particle identification in the BGO calorimeter for the identification of hyperon decays.

The first part of an extensive physics programme includes measurements of the differential cross section at forward angles for $\gamma p \to K^+\Lambda$ and, using linearly polarised photons, the beam asymmetry, Σ, for $\gamma p \to K^0\Sigma^+$. This latter measurement is focussed on the K^* threshold region where a cusp-like structure was recently observed in the total cross section.

Analysis of these reaction channels for both real and simulated data is presented.

Supported by DFG (SFB/TR-16).

HK 9.5 Mon 16:00 T/SR25

Observation of a new narrow axial-vector meson $a_1(1420)$ in diffractively produced $\pi^-\pi^+\pi^-$ final states at COMPASS — •Stefan Wallner[1] and Compass Collaboration[2] — [1]TU München E18 — [2]Cern

The COMPASS experiment studies the spectrum of hadrons and has acquired a large data sample of diffractively produced $\pi^-\pi^+\pi^-$ final states using a 190 GeV pion beam on a hydrogen target. The size of the data set permits to perform a partial-wave analysis with the largest wave set used so far consisting of 88 waves in bins of the squared four-momentum transfer t' from the beam to the target.

Based on this partial-wave decomposition, resonance parameters can be extracted by disentangling resonant and non-resonant parts of the partial waves in mass-dependent fits. The additional information obtained from the division in bins of the squared four-momentum transfer t', allows for a better separation of resonant and non-resonant parts, as they exhibit different t'-dependences.

Using this method, the resonance parameters of a new axial-vector state, the $a_1(1420)$, observed only in the $f_0(980)\,\pi$ decay mode, have been extracted.

We will present extensive studies that have been performed in order to investigate the systematic uncertainties of the resonance parameters, due to the applied fit model, the correlation with other waves or the event selection.

Supported by BMBF, MLL and the Excellence Cluster Universe.

HK 9.6 Mon 16:15 T/SR25

Hunting for $\mathbf{K^{*+}(892)}$ in 3.5 GeV pp reactions — •Dimitar Mihaylov — For the HADES collaboration — E12, Physics department, TU München — Excellence Cluster "Universe", Boltzmannstr. 2, 85748 Garching, Germany

The production of the kaon excitation state $K^{*+}(892)$ has not been previously investigated for pp collisions at energies near to the production threshold. The data provided by the HADES spectrometer for pp collisions at 3.5 GeV provide a great opportunity to investigate this state. This has been achieved by reconstruction of the decay channel $K^{*+}(892) \to K^0_S\pi^+ \to \pi^+\pi^-\pi^+$ and performing a single differential analysis in the p_T, p_{CM}, $cos\theta_{CM}$ and rapidity variables.

Apart from extending our current knowledge of the $K^{*+}(892)$ state, the result of this analysis will serve as a valuable reference for a future analysis of the available pNb data at the same energy, which will focus on investigating pn reactions, scattering reactions inside the nucleus and production of the $K^{*+}(892)$ through secondary processes (e.g. $\pi N \to K^{*+}\Lambda$).

The analysis of the pp data is in its final stages and preliminary results of the total production cross section, the dominant production channel and spin alignment properties of the $K^{*+}(892)$ are available.

This work is supported by the Excellence Cluster "Universe".