HK 63: Hadron Structure and Spectroscopy X

Zeit: Freitag 14:00–15:45 Raum: S1/01 A4

Gruppenbericht HK 63.1 Fr 14:00 S1/01 A4

Hyperons in nuclear matter from SU(3) chiral effective field theory — •Stefan Petschauer[1], Johann Haidenbauer[2], Norbert Kaiser[1], Ulf-G. Meissner[2,3], and Wolfram Weise[1,4] — [1]Technische Universität München — [2]Forschungszentrum Jülich — [3]Universität Bonn — [4]ECT*, Trento, Italy

Brueckner theory is used to investigate the properties of hyperons in nuclear matter. The hyperon-nucleon interaction is taken from chiral effective field theory at next-to-leading order with SU(3) symmetric low-energy constants. Furthermore, the underlying nucleon-nucleon interaction is also derived within chiral effective field theory. We present the single-particle potentials of Λ and Σ hyperons in symmetric and asymmetric nuclear matter computed with the continuous choice for intermediate spectra. The results are in good agreement with the empirical information. In particular, our calculation gives a repulsive Σ-nuclear potential and a weak Λ-nuclear spin-orbit force. The splittings among the Σ^+, Σ^0 and Σ^- potentials have a non-linear dependence on the isospin asymmetry which goes beyond the usual parametrization in terms of an isovector Lane potential.

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HK 63.2 Fr 14:30 S1/01 A4

Study of NΣ Cusp in p + p → p + K^+ + Λ with Partial Wave Analysis — •S. Lu[1], R. Muenzer[1], E. Epple[1], L. Fabbietti[1,3], J. Ritman[2], E. Roderburg[2], and F. Hauenstein[2] — [1]Excellenz Cluster Universe - Technische Universität München — [2]FZ Jülich — [3]Hades and FOPI Collaboration

In the last years, an analysis of exclusive reaction of p + p → p + K^+ + Λ has been carried out using Bonn-Gatchina Partial Wave Analysis. In a combined analysis of data from Hades, Fopi, Disto and Cosy-TOF, an energy dependent production process is determined. This analysis has shown that a sufficient description of the p + p → p + K^+ + Λ is quite challanging due to the presence of resonances N^* and interference, which requires Partial Wave Analysis. A pronounced narrow structure is observed in its projection on the pΛ-invariant mass. This peak structure, which appears around the NΣ threshold, has a strongly asymmetric structure and is interpreted a NΣ cusp effect. In this talk, the results from a combined analysis will be shown, with a special focus on the NΣ cusp structure and a description using Flatt$\grave{e}$ parametrization.*supported by the DFG Project FA 898/2-1

HK 63.3 Fr 14:45 S1/01 A4

Polarization Observables Measured in the Reaction $\vec{p}p \to pK^+\Lambda$ by COSY-TOF — •Florian Hauenstein for the COSY-TOF-Collaboration — Forschungszentrum Juelich, Juelich

The $\vec{p}p \to pK^+\Lambda$ reaction was measured with the COSY-TOF detector using a polarized proton beam with beam momenta 2.7 GeV/c and 2.95 GeV/c. The measurements with a polarized beam allow the determination of polarization observables in addition to the differential cross sections. These observables are the Λ polarization, the spin transfer to the Λ and the analyzing power of the final state particles. The latter is connected with the partial wave composition of the final state system, while the first two can improve the understanding of the underlying reaction mechanism of the associated strangeness production. Currently, no sophisticated models exist in this energy regime, thus, conclusive results concerning the reaction mechanism can not be drawn yet. Nevertheless, the obtained data are the first with full phase space acceptance and high statistics in this beam energy regime.

In this talk the extraction methods for the different polarization observables will be explained, and results for the polarization observables as a function of different variables will be shown. The dependencies of the results on the beam momentum will be discussed. Furthermore, a comparison with theoretical expectations from high energy physics for the Λ polarization will be given.

HK 63.4 Fr 15:00 S1/01 A4

Analysis of the reaction $\gamma p \to K^0\Sigma^+$ in the neutral decay channel at the BGO-OD experiment using kinematic fitting — •Stefan Alef for the BGO-OD-Collaboration — Physikalisches Institut Universität Bonn

The BGO-OD experiment at the ELSA facility in Bonn is built to investigate nucleon excitations via meson photoproduction. One research objective is associated strangeness production, which includes the reaction channel $\gamma p \to K^0\Sigma^+$.

Results of the analysis for the neutral decay channel $K^0\Sigma^+ \to \pi^0\pi^0\pi^0 p$ will be presented. Due to the small production cross section and branching ratio kinematic fitting is used to discriminate the reaction against background.

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HK 63.5 Fr 15:15 S1/01 A4

Inclusive Λ production in proton-proton at 3.5 GeV in HADES — •Rafal Lalik for the HADES-Collaboration — Excellence Cluster Universe, Technische Universität München, Boltzmannstr. 2, D-85748, Garching, Germany

The total production cross-section of Λ hyperions was measured with the HADES spectrometer at GSI Helmholtz in Darmstadt in the proton-proton reactions at $\sqrt{s}$ = 3.18 GeV. Experimental data were compared to data-driven model based on experimental results of Λ production in various exclusive channels measured in the same reaction at HADES. Beside phase-space production, contributions from $\Sigma(1385)$, Δ and N^* intermediate resonances has been considered. It is shown in Partial Wave Analysis of pKΛ channel that pure phase-space production does not describe all kinematical variables of the observed distributions and inclusion of coherent sum of intermediate resonances is necessary. The differential cross-sections of each contributing channel is extracted via fit to the experimental data providing full description of the Λ production in this energy regime.

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HK 63.6 Fr 15:30 S1/01 A4

A Three-Flavor Chiral Effective Model with Four Baryonic Multiplets within the Mirror Assignment — •Lisa Olbrich, Miklós Zétényi, Francesco Giacosa, and Dirk H. Rischke — Institute for Theoretical Physics, Goethe University Frankfurt am Main

Chiral symmetry requires the existence of chiral partners in the hadronic mass spectrum. In this talk, we address the question which is the chiral partner of the nucleon. We employ a chirally symmetric linear sigma model, where hadrons and their chiral partners are treated on the same footing. We construct four spin-1/2 baryon multiplets from left- and right-handed quarks as well as left- and right-handed diquarks. Two of these multiplets transform in a "mirror" way, which allows for chirally invariant mass terms. We then embed these baryonic multiplets into the Lagrangian of the extended Linear Sigma Model, which features (pseudo)scalar and (axial-)vector mesons, as well as glueballs. Reducing the Lagrangian to the two-flavor case, we obtain four doublets of nucleonic states. These mix to produce the positive-parity nucleon $N(939)$ and the Roper resonance $N(1440)$, as well as the negative-parity resonances $N(1535)$ and $N(1650)$. We determine the parameters of the nucleonic part of the Lagrangian from a fit to masses and decay properties of these states. Studying the limit of vanishing quark condensate, we conclude that $N(939)$ and $N(1535)$, as well as $N(1440)$ and $N(1650)$ form pairs of chiral partners.

[1] L. Olbrich, M. Zétényi, F. Giacosa, and D.H. Rischke, arXiv:1511.05035 [hep-ph].