HK 67: Hadron Structure and Spectroscopy 12

Time: Thursday 17:00–19:00 Location: T/SR25

Group Report HK 67.1 Thu 17:00 T/SR25

Status of $d^*(2380)$ and Search for further Dibaryon Resonances*. — •Mikhail Bashkanov for the WASA-at-COSY-Collaboration — Physikalisches Institut der Universität Tübingen

After evidence for the existence of a narrow dibaryon resonance with $I(J^P) = 0(3^+)$ had been found in various np-induced two-pion production channels, its pole has been identified now in polarized $\vec{n}p$ scattering. This qualifies the resonance as a genuine s-channel dibaryon resonance, denoted since then by $d^*(2380)$ [1]. Meanwhile, also all two-pion decay channels have been studied and decay branchings deduced.

Several new theoretical investigations in the framework of Faddeev or quark model treatments see this state at a mass close to the experimentally observed one – and partly also with the right width. Amazingly, the first prediction by Dyson and Xuong based on SU(6) symmetry breaking turns out to have been already very close.

These theoretical studies predict also another truly exotic state with mirrored quantum numbers $I(J^P) = 3(0^+)$, *i.e.* decoupled from the NN system and consisting of just six up-quarks in its $I_z = +3$ state. Such a state may be searched for in four-pion production. The status of this search by use of WASA data will be reported.

[1] P. Adlarson *et. al.*, Phys. Rev. Lett. 112 (2014) 202301 and Phys. Rev. C 90 (2014) 035204

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HK 67.2 Thu 17:30 T/SR25

Chiral Nucleon-Nucleon Potential: 3π-exchange with virtual Δ-isobar excitations — •Norbert Kaiser — Physik Department T39, Technische Universität München

The status of the chiral nucleon-nucleon potential at order N^4LO is presented. While the net 3π-exchange at this order is moderate, one finds a sizeable and prevailingly repulsive contribution from the two-loop 2π-exchange, thus compensating the excessive attraction at lower orders. As a result, the phase shifts of the peripheral partial waves are in very good agreement with empirical determinations. The three-pion exchange with excitations of nucleons to virtual Δ-isobars is studied as well. The analytical calculation of the pertinent two-loop spectral functions (by exploiting unitarity) reveals that these mechanisms generate mainly a repulsive isoscalar central NN-potential of moderate size.

D. Entem, N. Kaiser, R. Machleidt and Y. Nosyk, arXiv: 1411.5335.
This work has been supported in part by DFG and NSFC (CRC110).

HK 67.3 Thu 17:45 T/SR25

Hyperons in nuclear matter based on 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

We investigate properties of hyperons in nuclear matter within conventional first-order Brueckner theory based on potentials calculated within the framework of SU(3) chiral effective field theory. The chiral potentials include contributions from one- and two-meson exchange as well as contact terms up to next-to-leading order. Promising results for the single-particle potentials of Λ and Σ hyperons in nuclear matter and pure neutron matter are found. These calculations are fundamental for a systematic study of hypernuclei and of dense baryonic matter, like neutron star matter.

This work has been supported in part by DFG and NSFC (CRC110).

HK 67.4 Thu 18:00 T/SR25

Hyperon interaction in free space and nuclear matter — •Madhumita Dhar and Horst Lenske — Institute for Theoretical Physics, Justus- Liebig- University Giessen

Baryon-baryon interactions within the SU(3)-octet are investigated in free space and nuclear matter.A meson exchange model based on SU(3) symmetry is used for determining the interaction. The Bethe-Salpeter equations are solved in a 3-D reduction scheme. In-medium effect has been incorporated by including a two particle Pauli projector operator in the scattering equation. The coupling of the various channels of total strangeness S and conserved total charge is studied in detail. Special attention is paid to the physical thresholds. The density dependence of interaction is clearly seen in the variation of the in-medium low-energy parameters. The approach is compared to descriptions derived from chiral-EFT and other meson-exchange models e.g. the Nijmegen and the Juelich model. This work is supported by HIC for FAIR and HGS-HIRe.

HK 67.5 Thu 18:15 T/SR25

Probing the existence of the Kaonic Nuclear Cluster "ppK^-" with help of a PWA — •Eliane Epple for the HADES-Collaboration — Physik Dept. E12, Technische Universität München, Garching — Excellence Cluster "Universe", 85748 Garching

The "ppK^-" is a well established state in theory and is a candidate for a new kind of hadronic matter formed by antikaons and nucleons. The HADES spectrometer at GSI has probed the existence of such a state by measuring its possible decay products p and Λ. These decay products have been studied specifically in the reaction $p+p \rightarrow p+K^+ + \Lambda$ at a beam kinetic energy of 3.5 GeV. A partial wave analysis, performed on this final state, helped in describing the event distributions, which is a necessary condition to search for an additional small signal in the statistic. We have found no indication for the production of a kaonic nuclear bound state in our data and have, thus, set an upper limit for its production cross section.

Furthermore, did we repeat the analysis of the DISTO collaboration in which a signal like distribution appeared in so-called deviation spectra. We can show that this method is error-prone in terms of the applied selection cuts and is, thus, not reliable in order to make statements about the "ppK^-".

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HK 67.6 Thu 18:30 T/SR25

Study of 2.13GeV Cusp in $p + p \rightarrow p + K^+ + \Lambda$ with Partial wave Analysis using Flatté distribution. — •S. Lu[1], R. Münzer[1], E. Epple[1], L. Fabbietti[1], J. Ritman[2], E. Roderburg[2], F. Hauenstein[2], and Hades and FOPI Collaboration[2] — [1]E12 Physik Department, Excellenz Cluster Universe - Technische Universität München — [2]FZ Jülich

In the last years, the analysis of the reaction $p + p \rightarrow p + K^+ + \Lambda$ has been carried out by the FOPI and Hades Collaboration in the search for Kaonic Cluster ppK^-. This analysis has shown that a sufficient description of the $p + p \rightarrow p + K^+ + \Lambda$ is quite challanging due to the presence of resonances N^* and interference, which requires Partial wave Analysis. In a new analysis campaign a combined analysis of several additional data sets from DISTO and COSY-TOF can be analysed. A pronounced narrow structure is observed in its projection on the pΛ-invariant mass. This peak structure, which appears around the ΣN threshold, has a strongly asymmetric structure and is interpreted a ΣN cusp effect. To get a more precise physical interpretation of the data, the Flatté parameterization, which also takes the influence, is used. The influences of the coupling strength of Λp and Σp are taken into account. In this talk, several results from partial wave analysis of cusp structure based on Flatté parameteration will be presented.

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HK 67.7 Thu 18:45 T/SR25

Charge Symmetry Breaking in the $dd \rightarrow {}^4\mathrm{He}\pi^0$ Reaction with WASA-at-COSY — •Maria Zurek for the WASA-at-COSY-Collaboration — Forschungzentrum Jülich, Jülich, Germany

Investigations of charge symmetry breaking is one of the key topics for the WASA-at-COSY experiment. The study concentrates on the charge symmetry forbidden $dd \rightarrow {}^4\mathrm{He}\pi^0$ reaction. The aim is to compare the experimental results with Chiral Perturbation Theory predictions, probing hadronic effects of the up and down quarks mass difference.

It was found that previous data taken close to the reaction threshold were consistent with s-wave. In order to probe also p-wave contributions, new data at sufficiently high energy were required. The measurement should comprise the charge symmetry forbidden $dd \rightarrow {}^4\mathrm{He}\pi^0$ reaction and the charge symmetry conserving reaction $dd \rightarrow {}^3\mathrm{He}n\pi^0$ to provide additionally the experimental input for the description of the initial state interactions.

Results on the $dd \rightarrow {}^3\mathrm{He}n\pi^0$ and $dd \rightarrow {}^4\mathrm{He}\pi^0$ reactions with the WASA detector setup at a beam momentum of 1.2 GeV/c will be presented. In addition, the status of the recent high statistics run in spring 2014 will be discussed.