

## HK 11: Hadronenstruktur und -spektroskopie III

Time: Monday 16:30–19:00

Location: C-2

**Group Report**

HK 11.1 Mon 16:30 C-2

**Chiral perturbation theory in the single-baryon sector** — TIM LEDWIG, •VLADIMIR PASCALUTSA, and MARC VANDERHAEGHEN — Institut für Kernphysik, Johannes Gutenberg Universität, Mainz D-55099, Germany

A brief account of baryon chiral perturbation theory (BChPT) will be given with emphasis on the issues of consistent power-counting and convergence. Several recent calculations in the single baryon sector will be presented and confronted with lattice QCD results and/or experimental data. Special attention is paid to a new BChPT calculation of Compton scattering off protons which questions the current PDG values of proton polarizabilities.

HK 11.2 Mon 17:00 C-2

**Thermal dilepton rate and electrical conductivity from quenched lattice QCD** — •ANTHONY FRANCIS — Universitaet Bielefeld

We calculate the vector current correlation function for light valence quarks in the deconfined phase of QCD. The calculations were performed in quenched lattice QCD at  $T=1.45T_c$  for four values of the lattice cut-off on lattices up to size  $N_s=128 \times N_t=48$ . This enables a continuum extrapolation of the correlation function in a large Euclidean time interval to better than 1% accuracy. In addition the first two non-vanishing thermal moments are determined. Overall we can conclude that the vector correlation function at this temperature never deviates by more than 9% from the free massless correlator, while the moment stays within 7% of the corresponding free value. We discuss consequences of our findings for the electrical conductivity and dilepton rate in a quark gluon plasma.

HK 11.3 Mon 17:15 C-2

**Hadronization in Cold Nuclear Matter** — •KAI GALLMEISTER and ULRICH MOSEL — Institut für Theoretische Physik, Universität Giessen, Germany

We study the hadron attenuation measured in semi inclusive particle production at CLAS, HERMES and EMC within the semi classical transport model GiBUU. By comparing different scenarios for the hadronization we get information about the underlying space time picture. Also the data for exclusive pion and rho production off nuclei is described by our calculations. In addition, we also compare calculations for the production of charged pions by pion or proton beams off nuclei with recent data of the HARP collaboration for beam energies from 3 up to 13 GeV. While originally designed for calibrating the flux for neutrino induced experiments, the data from this experiment represents a valuable check for hadronization and final state interaction models.

Supported by BMBF.

HK 11.4 Mon 17:30 C-2

**Chiral symmetry and medium modifications of mesons** — •THOMAS HILGER<sup>1</sup>, BURKHARD KÄMPFER<sup>1</sup>, SERGEY DORKIN<sup>2</sup>, LEONID KAPTARI<sup>2</sup>, and STEFAN LEUPOLD<sup>3</sup> — <sup>1</sup>Forschungszentrum Dresden-Rossendorf, PF 510119, 01314 Dresden — <sup>2</sup>Joint Institute for Nuclear Research Joliot-Curie 6 141980, Dubna Moscow Region, Russia — <sup>3</sup>Univ. of Uppsala Box 256 S-75121 Uppsala, Sweden

Using QCD sum rules we investigate the in-medium behavior of pseudo-scalar and vector mesons. The rho meson is considered within a scenario of pure chiral restoration by dropping the chirally odd condensates. The interplay of mass shift and broadening of the spectral function is highlighted. We apply finite density QCD sum rules to mesons consisting of a heavy and a light quark (D, Ds and B) and investigate their sensitivity to the chiral condensate and consider the splitting of particle and antiparticle spectral functions with increasing density of the ambient nuclear matter. In order to gain a more direct dependence on the chiral condensate and other potential order parameters of chiral symmetry we present a series of Weinberg-Shuryak type sum rules for heavy-light systems at finite densities. Furthermore, the special role of the gluon condensates for systems consisting of two heavy quarks (e.g. J/Psi) and the QCD trace anomaly allows an extension of the method to large temperatures at non-zero baryon densities using the Rossendorf quasi-particle model. We present first results of a Dyson-Schwinger Bethe-Salpeter approach.

HK 11.5 Mon 17:45 C-2

**In-Medium Modifikationen des  $\omega$ -Mesons nahe der Produktionsschwelle\*** — •MICHAELA THIEL für die A2-Kollaboration — II. Physikalisches Institut, Universität Gießen, Deutschland

Mit Hilfe des Reaktionskanals  $\gamma + A- > \omega + X- > \pi^0\gamma + X$  soll untersucht werden, ob das  $\omega$ -Meson eine Modifikation in Kernmaterie erfährt. Wie GiBUU Simulationen [1] gezeigt haben, sind die Auswirkungen von In-Medium Effekten auf die  $\omega$ -Meson Linienform klein, aber am wahrscheinlichsten im Bereich der Produktionsschwelle ( $E_{\gamma,thresh} = 1108$  MeV) nachzuweisen. Neben der Linienform des  $\omega$ -Mesons wurde auch die Impulsverteilung für verschiedene Szenarien berechnet [2]. Mit dem Upgrade der Beschleunigeranlage in Mainz zu MAMI C stehen Photonenenergien bis 1600 MeV zur Verfügung, die eine Untersuchung der Photoproduktion von  $\omega$ -Mesonen in der Nähe der Produktionsschwelle am freien Nukleon ermöglichen. In 2008 wurde an Kohlenstoff und Niob Kernen die Photoproduktion von  $\omega$ -Mesonen im Energiebereich 900 bis 1300 MeV mit Hilfe des CrystalBall / TAPS Detektorsystems untersucht. In der Datenanalyse wurde die Linienform sowie die Impulsverteilung der  $\omega$ -Mesonen untersucht. Die Ergebnisse der Analyse sowie Vergleiche zu GiBUU Simulationen werden in diesem Vortrag präsentiert. \* Gefördert durch die DFG (SFB / TR-16)

[1] <http://gibuu.physik.uni-giessen.de/GiBUU>

[2] J. Weil, private Mitteilung

HK 11.6 Mon 18:00 C-2

**Measurement of the in-medium  $\phi$ -meson width in proton-nucleus collisions** — •ANDREY POLYANSKIY for the ANKE-Collaboration — Institut für Kernphysik und Jülich Center for Hadron Physics, Forschungszentrum Jülich

The production of  $\phi$ -mesons in collisions of 2.83 GeV protons with C, Cu, Ag and Au targets has been measured with the ANKE magnetic spectrometer at the Cooler Synchrotron COSY. The  $\phi$  was detected at small angles via its  $K^+K^-$  decay branch. The measured target mass dependence of the production cross section can be related to the in-medium  $\phi$  width. Comparisons with available model calculations suggest a significant broadening of this width relative to the vacuum value of 4.3 MeV/ $c^2$ . Since this was a high statistics experiment, with 7000-10000  $\phi$  per target, we were able to study the momentum dependence of the in-medium  $\phi$  width and results will be presented in the range  $0.6 < p_\phi < 1.6$  GeV/ $c$ .

Supported by the COSY-FFE program.

HK 11.7 Mon 18:15 C-2

**Investigating the in-medium properties of the  $\phi(1020)$ .** — •OLAF N. HARTMANN for the J-PARC P29-Collaboration — Stefan-Meyer-Institut der ÖAW, Wien, Österreich

The study of the in-medium properties of the  $\phi(1020)$  has been already addressed by various experiments through different reaction channels. Deviations of the vacuum properties, like large  $\phi$ -nucleon cross sections in nuclei, have been reported. The KEK PS-E325 experiment claims a reduced in-medium  $\phi$  mass by 3.5 % [1]. To further examine this effect, the E29 experiment at J-PARC proposed to search for a  $\phi$  meson bound state in nuclei. The reaction channel  $\bar{p}p \rightarrow \phi\phi$  will be used to allow the trapping of one slow  $\phi$  meson in the nucleus. A bound state can be identified by missing mass spectroscopy of the second  $\phi$  meson. The first step of E29 will be the measurement of the cross section of  $\bar{p}p \rightarrow \phi\phi$  in nuclear targets. In this contribution, the experimental concept will be presented. [1] R. Muto et al., PRL 98 (2007) 042501.

HK 11.8 Mon 18:30 C-2

**In-Medium Properties of the Eta-prime Meson\*** — •MARIANA NANOVA for the CBELSA/TAPS-Collaboration — II. Phys. Institut, Universität Giessen

The investigations of in-medium properties of the  $\eta'$  meson will be presented. The photoproduction of  $\eta'$  mesons off  $^{12}\text{C}$ ,  $^{40}\text{Ca}$ ,  $^{93}\text{Nb}$  and  $^{208}\text{Pb}$  nuclei has been measured. The experiment was performed at the ELSA accelerator in Bonn with the combined setup of the Crystal Barrel and TAPS detectors. Recent results on the in-medium width of the  $\eta'$  meson, derived from the transparency ratio measurements, will be presented and compared to results for the  $\omega$  meson and to theoretical calculations. The absorption of the  $\eta'$  meson in nuclear matter as a function of its kinetic energy will be discussed.

\*supported by the DFG(SFB/TR-16)

HK 11.9 Mon 18:45 C-2

**In-Medium Properties of Vector Mesons in a Transport Approach** — ●JANUS WEIL and ULRICH MOSEL — Institut für Theoretische Physik, Universität Giessen, Germany

We investigate in-medium properties of vector mesons with the GiBUU transport model [1]. On the one hand we present simulation results of dilepton spectra from pp, pA and AA reactions, as measured by the HADES detector at GSI [2], on the other hand we also treat hadronic

decay modes like  $\omega \rightarrow \pi^0 \gamma$ , which is being studied experimentally by the TAPS group [3]. Our analysis aims for an investigation of in-medium modifications of the light vector mesons in nuclear matter, e.g. via collisional broadening and mass shifts, and the question how experimentally accessible observables are influenced by such effects. Work supported by HGS-HIRe.

[1] <http://gibuu.physik.uni-giessen.de>

[2] I. Fröhlich et al., Int.J.Mod.Phys.A24 (2009) 317-326.

[3] M. Nanova, J. Weil et al., arXiv:1008.4520 (2010).