HK 24: Hadron Structure and Spectroscopy I

Time: Tuesday 14:00–16:00 Location: H-ZO 20

Invited Group Report HK 24.1 Tu 14:00 H-ZO 20

The PANDA experiment at FAIR — •Paola Gianotti — INFN - Laboratori Nazionali di Frascati, Via E. Fermi 40, 00044 Frasscati, Italy

Though strong interaction has been studied for quite a long time, recent findings of new and unexpected resonances, with unresolved properties like the X(3872), show that the hadron spectrum is far from beeing completely understood. This is also underlined by the ongoing discussion on the existence of multi-quark states, and other exotic states with gluonic degrees of freedom.

An antiproton beam of unprecedent intensity and quality will be soon available at the HESR machine, foreseen as one of the the new FAIR accelerators of Darmstadt. This tool, together with a properly designed new detector (PANDA), will be the ideal environment to copiously produce a wide spectrum of hadrons.

In the past, experiments with antiprotons have already demonstrated to be a rich source of information on many aspects of non-perturbative QCD. The better characteristics of the beam, and the new generation experimental setup will allow to address and clarify most of the open questions in a direct way.

A review of the PANDA experimental progam, and of the detector setup, will be given.

Group Report HK 24.2 Tu 14:30 H-ZO 20

Physics Performance Studies for PANDA at FAIR — •Jan Zhong for the PANDA-Collaboration — Experimentalphysik I, Ruhr-Universität Bochum, 44780 Bochum

With the PANDA experiment at FAIR, it will be possible to study antiproton-proton and antiproton-nucleus collisions up to $\sqrt{s} = 5.5$ GeV. PANDA will cover a broad physics program including hadron spectroscopy, search for gluonic excitations, charmed hadrons in matter, investigation of the structure of the nucleon, and hypernuclear spectroscopy. For a large number of benchmark channels, extensive Monte Carlo simulations have been done in order to determine the acceptance, the reconstruction efficiencies, and background rejection capabilities of the detector. The results of these simulations studies will be presented. Supported by bmb+f and the European Union.

HK 24.3 Tu 15:00 H-ZO 20

Topics in Meson Photoproduction with Crystal Ball/TAPS at MAMI — •Sven Schumann for the A2-Collaboration — Institut für Kernphysik, Johannes Gutenberg-Universität Mainz

Since June 2004 the Crystal Ball/TAPS detector setup at the Mainz Mikrotron (MAMI) is used for experiments with energy-tagged real photons on liquid H_2/D_2 and various solid targets. The photon beam is produced in the bremsstrahlung process by the Glasgow-Mainz tagging system. The Crystal Ball as a spherical segmented photon spectrometer (672 NaI(Tl) crystals) in combination with the TAPS detector as a forward wall provides a solid angle coverage of nearly 4π; additional inner detectors are used for particle identification and track reconstruction. The experimental programme includes topics like photoexcitation of nucleon resonances in π^0 and η production, structure investigation of baryons (such as the $\Delta^+(1232)$ magnetic dipole moment determination), rare meson decays (η, ω), a new measurement of the η mass and studies of nuclear mass distributions using coherent π^0 production on nuclei. An overview of the various experiments and results from both the MAMI-B (883 MeV beam energy) and also the new MAMI-C (1,5 GeV beam energy, operational since 2006) runs will be presented.

HK 24.4 Tu 15:15 H-ZO 20

Diffractive Pion Dissociation into 5 Pion Final States at COMPASS — •Sebastian Neubert[1], Suh-Urk Chung[1,2], Jan Friedrich[1], Stefanie Grabmüller[1], Florian Haas[1], Bernhard Ketzer[1], Stephan Paul[1], Dimitry Ryabchikov[1,3], and Quirin Weitzel[1] for the COMPASS-Collaboration — [1]Technische Universität München, Physik Department E18, 85748 Garching Germany — [2]Brookhaven National Laboratory, Upton, NY 11973, USA — [3]Institute for High Ernergy Physics, 142284 Protvino, Russia

COMPASS is a fixed-target experiment at the CERN SPS, which investigates the structure and spectroscopy of hadrons. In 2004, a first run with a 190 GeV/c π^- beam took place using nuclear targets. Diffractive dissociation reactions observed in this run provide clean access to meson resonances with masses up to 3 GeV/c^2 . Exclusive final states with 5 charged pions have been extracted. The covered range in momentum transfer extends from threshold to a few GeV$^2/c^2$ allowing to study resonance production in different regimes. We will report on the status of the analysis of this unique data set.

HK 24.5 Tu 15:30 H-ZO 20

Photoproduction of η-mesons off the deuteron — •Dominik Werthmüller for the A2-Collaboration — Department of Physics, University of Basel

Photoproduction of η-mesons off a liquid deuterium target has been measured using bremsstrahlung photons produced by MAMI-C with incident energies up to 1.5 GeV. The η-meson was detected through its neutral decays into 2γ and $3\pi^0 \to 6\gamma$, respectively, in a combined setup of the Crystal Ball calorimeter and a TAPS forward wall which results in an almost 4π acceptance. Previous experiments performed by the CBELSA/TAPS and the GRAAL collaborations studying η-photoproduction on the deuteron revealed a bump-like structure of still unknown nature in the quasi-free neutron excitation function around $E_\gamma = 1$ GeV that is not found for the proton. The present experiment aimed at a significant improvement of the statistical quality of the data, in particular for η-mesons at backward angles. Preliminary results for the inclusive $\gamma(d,\eta)X$, the semi-exclusive $\gamma(d,\eta)NN$, and the fully exclusive reactions measured in coincidence with the recoil nucleons will be presented.

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HK 24.6 Tu 15:45 H-ZO 20

Time-like form factors of the nucleon — •Julia Guttmann[1], Andreas Metz[2], and Marc Vanderhaeghen[1] — [1]Institut für Kernphysik, Johannes Gutenberg-Universität, 55099 Mainz — [2]Temple University, Philadelphia, USA

The electromagnetic form factors are an important tool to explore the structure of the nucleon. The extraction of space-like form factors from electron-proton scattering shows a discrepancy between data of unpolarized Rosenbluth measurements and of polarization experiments. This difference can be explained by means of two-photon exchange corrections. In the time-like region no comparable calculations have been done up to now for the corresponding processes.

We investigate the influence of two-photon exchange in the reaction $\bar{p}p \to e^+e^-$ with regard to determination of the time-like form factors and present calculations for future experiments at the PANDA@FAIR project.