

## HK 35: Elektromagnetische und Hadronische Sonden

Zeit: Mittwoch 17:00–18:30

Raum: A

HK 35.1 Mi 17:00 A

**Single-Pion Production at  $T_p = 400$  MeV and the Excitation of the  $\Delta$  Resonance\*** — ●EVGUENI DOROSHKEVICH, HEINZ CLEMENT, KATHARINA EHRHARDT, ARTHUR ERHARDT, and GERHARD WAGNER for the COSY-TOF-Collaboration — Physikalisches Institut der Universität Tübingen, Auf der Morgenstelle 14, D-72076 Tübingen

The single-pion production in nucleon-nucleon collisions has been measured at COSY-TOF at  $T_p = 400$  MeV over the complete phase space region. In  $pp \rightarrow pp\pi^0$  the  $\Delta$  excitation is heavily suppressed near threshold - though an intermediate  $p\Delta^+$  configuration with the two constituents being in relative  $p$ -wave can be sensed in the angular distributions [1].

The  $pp \rightarrow np\pi^+$  reaction on the other hand appears to be strongly dominated by the  $\Delta$  excitation process with  $n\Delta^{++}$  and  $p\Delta^+$  configurations in the intermediate state, as can be observed in the Dalitzplot together with its invariant mass projections as well as in the angular distributions.

[1] S. Abd El-Samad et al, EPJ **A30** (2006) 443

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HK 35.2 Mi 17:15 A

**Excitation of the Roper Resonance in Single- and Double-Pion Production\*** — TATIANA SKORODKO<sup>1</sup>, ●HEINZ CLEMENT<sup>1</sup>, MIKHAIL BASHKANOV<sup>1</sup>, EVGUENI DOROSHKEVICH<sup>1</sup>, MURAT KASKULOV<sup>2</sup>, OLENA KHAKIMOVA<sup>1</sup>, FLORIAN KREN<sup>1</sup>, and GERHARD WAGNER<sup>1</sup> for the CELSIUS-WASA-Collaboration — <sup>1</sup>Physikalisches Institut der Universität Tübingen, Auf der Morgenstelle 14, D-72076 Tübingen — <sup>2</sup>Institut für Theoretische Physik, Universität Giessen

The Roper resonance has been a puzzle ever since its detection in  $\pi N$  phase shifts. In most investigations no apparent resonance signatures could be found in the observables. Not only its nature has been a matter of permanent debate, also its resonance parameters show a big scatter in their values.

In the  $pp \rightarrow np\pi^+$  reaction measured at CELSIUS-WASA at several energies a pronounced resonance structure at  $M_{n\pi^+} \approx 1350$  MeV with  $\Gamma \approx 140$  MeV has been found. These numbers agree very favourably with recent SAID  $\pi N$  phase shift results for the Roper pole as well as with the very recent BES results from  $J/\psi \rightarrow \bar{N}N^*$ . With the pole position being roughly 100 MeV below the previously believed value of the  $N^*(1440)$ , also its decay branchings (defined at the pole position) change dramatically. From near-threshold two-pion production, when Roper excitation is the only significant process, we find the decay  $N^* \rightarrow N\sigma$  to be the by far dominant process pointing to a breathing mode nature of the Roper resonance.

\*supported by BMBF (06 TU 261), DFG (Europ. Grad. School), COSY-FFE

HK 35.3 Mi 17:30 A

**Study of the near threshold  $\eta$  meson production in the deuteron-proton collision.** — ●CEZARY PISKOR-IGNATOWICZ, PAWEŁ MOSKAŁ, and JERZY SMYRSKI for the COSY-11-Collaboration — Institute of Physics, Jagellonian University, 30-059 Cracow, Poland

The interaction of the  $\eta$  meson in the three nucleon system is intensively studied on theoretical grounds. This topic is of the special interest due to the possible existence of  $\eta$ -nucleus bound or quasi-bound states. Thus, near threshold experimental data on the production of the  $\eta$  meson in deuteron-proton collisions are of great importance. An improvement of the existing data base is also crucial for the understanding of the  $\eta$  meson production mechanism and the interaction of this meson with the nucleon. Measurements of excitation functions for the  $dp \rightarrow {}^3\text{He}X$  and  $dp \rightarrow dpX$ , ( $X = \pi^0, \eta$ ) reactions [1] near the  $\eta$  production threshold have been conducted by the COSY-11 collaboration using a deuteron beam of the cooler synchrotron COSY and a hydrogen cluster target. For the  ${}^3\text{He}X$  channel the data were taken during a slow ramping of the COSY deuteron beam momentum and for the  $dpX$  channel at three discrete beam energies. The excitation function for the reaction  $dp \rightarrow {}^3\text{He}\pi^0$  does not show any structure which could originate from the decay of a  ${}^3\text{He} - \eta$  bound state. In the excitation curve for the  $dp \rightarrow {}^3\text{He}X$  process, however, contrary to the SATURNE results, we observe no cusp near the  $\eta$  threshold. The

excitation functions for the  $dp \rightarrow {}^3\text{He}\pi^0$ ,  $dp \rightarrow {}^3\text{He}\eta$ , and  $dp \rightarrow dp\eta$  reactions near threshold for the  $\eta$  meson production will be presented and discussed. [1] J. Smyrski et al., *Acta Phys. Slovaca* **56** 213 (2006).

HK 35.4 Mi 17:45 A

**Mechanism of near-threshold production of the  $\eta$  meson by means of the analysing power measurements** — ●RAFAŁ CZYZYKIEWICZ<sup>1,2</sup> and PAWEŁ MOSKAŁ<sup>1,2</sup> for the COSY-11-Collaboration — <sup>1</sup>Institute of Physics, Jagellonian University, 30-059 Cracow, Poland — <sup>2</sup>IKP, Forschungszentrum Jülich, 52425 Jülich, Germany

We report on measurements of the analysing power  $A_y$  for the  $\bar{p}p \rightarrow pp\eta$  reaction. Experiments have been performed in the near threshold energy regime at beam momenta of  $p_{beam} = 2.010$  and  $2.085$  GeV/c, corresponding to excess energies of  $Q = 10$  and  $36$  MeV, respectively. The experiments were realised by means of the cooler synchrotron and storage ring COSY along with a cluster jet target. For registration of the reaction products the COSY-11 facility was used. The identification of the  $\eta$  meson has been performed with the missing mass method.

Results for the angular dependence of the analysing power combined with the previously determined isospin dependence of the total cross section for the  $\eta$  meson production in nucleon-nucleon collisions reveal statistically significant evidence that the excitation of the nucleon to the  $S_{11}$  resonance, the process which intermediates the production of the  $\eta$  meson, is predominantly due to the exchange of a  $\pi$  meson between the colliding nucleons.

The determined values of the analysing power are consistent with zero implying that the  $\eta$  meson is produced predominantly in the  $s$ -wave at both studied excess energies.

HK 35.5 Mi 18:00 A

**Study of the  $\eta$  and  $\eta'$  meson production in the quasi-free proton-neutron reactions at COSY-11** — ●BARBARA REJDYCH, RAFAŁ CZYZYKIEWICZ, PAWEŁ MOSKAŁ, and JOANNA PRZERWA for the COSY-11-Collaboration — Institute of Physics, Jagellonian University, 30-059 Cracow, Poland

Using a proton beam and a deuteron target the quasi-free  $pn \rightarrow pn\eta$ ,  $pn \rightarrow pn\eta'$  and the  $pn \rightarrow dn'$  reactions have been measured at the COSY-11 facility. The experiments have been performed in order to study an isospin dependence of the total cross section for the  $\eta$  and  $\eta'$  meson production in nucleon-nucleon collisions. These data, together with previous results obtained for the production of the mesons in collisions of protons should reduce significantly the ambiguities of theoretical descriptions of the production mechanism of the  $\eta'$  meson production in the nucleon-nucleon interaction.

The data taking has been completed in February 2006. Preliminary results will be presented and discussed. The presentation will include a description of the experimental technique used as well as the method invented for the separation of contributions from the multi- and single-meson production in the missing mass spectra of the quasi-free  $pn \rightarrow pnX$  process extracted from the measured  $pd \rightarrow pnXp_{spectator}$  reactions [1].

[1] P. Moskał et al., *J. Phys. G* **32** (2006) 629.

HK 35.6 Mi 18:15 A

**Precise measurement of the total width of the  $\eta'$  meson** — ●ERYK CZERWIŃSKI<sup>1</sup>, DIETER GRZONKA<sup>2</sup>, and PAWEŁ MOSKAŁ<sup>1,2</sup> for the COSY-11-Collaboration — <sup>1</sup>IP, Jagellonian University, 30-059 Cracow, Poland — <sup>2</sup>IKP, FZJ, 52425 Jülich, Germany

The physics of the  $\eta'$  meson receives an increasing interest in view of the forthcoming measurements planned e.g. at the COSY, DAΦNE-2 and MAMI-C facilities where the  $\eta'$  will be produced in hadron-hadron,  $e^+e^-$ , and  $\gamma$ -hadron reactions, respectively. Therefore, a precise determination of the natural line width of the  $\eta'$  ( $\Gamma_{\eta'}$ ) meson will have a strong impact on the physics results which will be derived from future measurements at the detector setups like e.g. WASA-at-COSY [1] and KLOE [2]. Among the only two previous direct measurements of  $\Gamma_{\eta'}$  the one performed by the NIMROD collaboration extracted the width of the  $\eta'$  meson with the smallest error  $\Gamma_{\eta'} = 0.28 \pm 0.1$  MeV [3]. At the COSY-11 facility, combined with the excellent features of the COSY proton beam, the natural width of the  $\eta'$  meson can be determined with at least five times better precision due to better experi-

mental resolution, larger statistics, better signal to background ratio, and finally due to a simultaneous use of two independent methods for the derivation of the width of the  $\eta'$  meson. The experimental method used and preliminary results of the ongoing analysis will be presented

and discussed.

[1] H.-H. Adam, *et. al.* **nucl-ex/0411038** (2004); [2] F. Ambrosino *et. al.*, **hep-ex/0603056** (2006); [3] D. M. Binnie *et. al.*, Phys. Lett. **B 83**, 141 (1979)