

HK 9 Elektromagnetische und Hadronische Proben

Zeit: Freitag 16:30–19:00

Raum: TU MA004

Gruppenbericht

HK 9.1 Fr 16:30 TU MA004

Threshold production of open strangeness at COSY-11 — ●PETER WINTER for the COSY-11 collaboration — Institut für Kernphysik, Forschungszentrum Jülich

Strangeness production in proton-proton collisions enables to study not only nucleon-hyperon but also the KN and $K\bar{K}$ interaction. The COSY-11 detection system is perfectly suited to investigate such reactions in the near threshold energy region. Exclusive data on hyperon production and open strangeness ($pp \rightarrow ppK^+K^-$) have been collected. The data in the $pp \rightarrow pK^+\Lambda/\Sigma^0$ reactions revealed a cross section ratio $R = \sigma_{tot}(\Lambda)/\sigma_{tot}(\Sigma^0) \approx 28$ exceeding by an order of magnitude that at high energies. Different models within the framework of one-boson exchange cannot well reproduce this strong rise towards low excess energies Q . Additional information in other isospin channels will impose further constraints to theoretical descriptions and help to clarify the dominant reaction mechanisms. For this purpose, the COSY-11 collaboration gathered data in the channel $pp \rightarrow nK^+\Sigma^+$ at $Q = 13$ and 60 MeV. Besides the hyperon sector, exclusive data on the $pp \rightarrow ppK^+K^-$ reaction have been taken at excess energies of $Q = 10$ and 28 MeV where final state interactions (FSI) of the outgoing particles are pronounced. A strong enhancement of the total cross section close to the threshold compared to a pure phase space expectation is supported by the new data sets. Since the strong pp-FSI is not sufficient to explain this effect, it remains an open question if the rise origins e.g. from the K^-p system which should be dominated by the $\Lambda(1405)$, a K^+K^- interaction or effects from the 4-body final state. This work is supported by FZ-Jülich and DAAD.

HK 9.2 Fr 17:00 TU MA004

Strangeness production in pD interactions at ANKE/COSY — ●Y. VALDAU for the ANKE collaboration — Forschungszentrum Jülich, 52425 Jülich

ANKE is a magnetic spectrometer and detection system at an internal target position of COSY-Jülich. The device permits to momentum analyze ejectiles from hadronic interactions with forward emission angles around 0° . A major goal of the experimental program at ANKE is the investigation of proton-induced strangeness production in the nuclear medium. The K^+ -production cross section in elementary pn collisions is an important input parameter for model calculations on K^+ -production in pA and AA interactions. Experimental data in the close to threshold region are not available yet and theoretical predictions give various numbers ranging from one to six for the ratio of total cross sections σ_n/σ_p depending on the underlying model. The ANKE spectrometer at COSY-Jülich has been used to measure K^+ production in pD interactions at beam momenta of 2.055, 2.095, 2.65, 2.7, 2.83 and 3.46 GeV/c. For the extraction of σ_n/σ_p from the pD data at 2.65, 2.7 and 2.83 GeV/c, a naive phase-space approach has been used assuming that $\sigma_D = \sigma_n + \sigma_p$. Cross sections and missing mass spectra for proton-kaon correlations have been obtained, and a ratio $\sigma_n/\sigma_p \sim 3-5$ has been found. The analysis of data measured below the free nucleon-nucleon K^+ production threshold as well as higher energy data will be presented. Supported by FZ-Jülich, DFG, WtZ.

HK 9.3 Fr 17:15 TU MA004

Observation of an excited neutral hyperon state in pp collisions* — ●IZABELLA ZYCHOR¹, VLADIMIR KOPTEV², MARKUS BÜSCHER³, MICHAEL HARTMANN³, IRAKLI KESHELASHVILI³, VERA KLEBER⁴, RUDIGER KOCH³, SIGFRIED KREWALD³, YOSHIKAZU MAEDA³, SIERGIEJ MIKIRTYCHIANTS², MICHAEL NEKIPELOV^{2,3}, and HANS STRÖHER³ for the ANKE collaboration — ¹The Andrzej Soltan Institute for Nuclear Studies, 05400 Świerk, Poland — ²High Energy Physics Department, Petersburg Nuclear Physics Institute, 188350 Gatchina, Russia — ³Institut für Kernphysik, Forschungszentrum Jülich, 52425 Jülich, Germany — ⁴Institut für Kernphysik, Universität zu Köln, 550937 Köln, Germany

The reaction $pp \rightarrow pK^+Y^{0*} \rightarrow pK^+\pi^\pm X^\mp$ has been studied with the ANKE spectrometer at COSY Jülich in order to investigate heavy hyperon production. The momentum of the proton beam, incident on a hydrogen cluster-jet target, was 3.65 GeV/c. Protons, kaons and pions were identified with the ANKE detector system consisting of range telescopes, scintillation counters and multi-wire proportional chambers. The missing mass spectra $MM(pK^+)$ have been analyzed for both positive

and negative charge final states and compared with extensive Monte Carlo simulations. Indications for a neutral excited hyperon resonance $Y^{0*}(1480)$ have been found. Consistent results for its mass and width as well as a production cross section were obtained for both final states. Experimental details, analysis procedure and a possible interpretation of this state will be discussed.

* supported by FZJ, BMBF, DFG

HK 9.4 Fr 17:30 TU MA004

ϕ -meson production in pp collisions* — ●M. HARTMANN¹, Y. MAEDA¹, I. KESHELASHVILI¹, H.R. KOCH¹, S. MIKIRTYCHIANTS², and H. STRÖHER¹ for the ANKE collaboration — ¹Institut für Kernphysik, Forschungszentrum Jülich, 52425 Jülich, Germany — ²High Energy Physics Department, Petersburg Nuclear Physics Institute, 188350 Gatchina, Russia

At the ANKE facility of COSY Jülich, data on ϕ -meson production in pp collisions in the near-threshold region have been obtained at incident beam energies of 2.83 GeV, 2.70 GeV and 2.65 GeV [1]. Detecting the K^+K^- decay mode we have identified 200-300 ϕ -mesons at each excess energy of 76 MeV, 35 MeV and 19 MeV, respectively. The energy dependence of the total cross section close to threshold will potentially give information on the production mechanism, in particular on the ϕNN coupling constant. Furthermore our result, combined with available SPES-III and TOF results on ω -meson production, will provide information about violations of the OZI-rule.

As an exciting aspect an enhancement in the invariant ϕp mass spectrum is observed at a mass around 1.965 GeV/c².

* supported by FZ-Jülich.

[1] Presented at the conference BARYONS 2004. Will be published in the journal Nuclear Physics A.

HK 9.5 Fr 17:45 TU MA004

ϕ -meson production in pn collisions* — ●YOSHIKAZU MAEDA¹, MICHAEL HARTMANN¹, IRAKLI KESHELASHVILI¹, RÜDIGER KOCH¹, SERGEY MIKIRTYCHIANTS², and HANS STRÖHER¹ for the ANKE collaboration — ¹Institut für Kernphysik, Forschungszentrum Jülich, 52425 Jülich, Germany — ²High Energy Physics Department, Petersburg Nuclear Physics Institute, Russia

ϕ -meson production in both hadronic and electromagnetic processes has attracted the interest for the investigation of hidden strangeness in nucleon and the violation of the Okubo-Zweig-Iizuka rule. At the ANKE facility of COSY Jülich, first data of ϕ -meson production in pn collisions close to threshold have been measured using a proton beam on a deuterium cluster-jet target. The reaction $pn \rightarrow d\phi$ has been identified by detecting the fast deuteron in coincidence with the K^+K^- pairs from the ϕ decay. About 1000 clean events of ϕ -meson production have been accumulated. The data cover an excess energy range up to 80 MeV exploiting Fermi motion of the target neutron. The total cross section and angular dependence at several energies will be presented and discussed.

* supported by FZ-Jülich

HK 9.6 Fr 18:00 TU MA004

Untersuchungen zu $pp \rightarrow pK^0\Sigma^+$, $pp \rightarrow nK^+\Sigma^+$ bei $p_{beam} = 2.95$ und 3.2 GeV/c — ●LEONHARD KARSCH, K.-TH. BRINKMANN, S. DSHEMUCHADSE, H. FREIESLEBEN, E. KUHLMANN, R. JÄKEL, M. SCHULTE-WISSERMANN und G.Y. SUN — TU Dresden*

Einer der Schwerpunkte des Meßprogramms am Kühler-Synchrotron COSY ist die Produktion von Hyperonen im Proton-Proton-Stoß. Für die Reaktion $pp \rightarrow pK^0\Sigma^+$ gab es bisher nur wenige schwelennahe Messungen, für $pp \rightarrow nK^+\Sigma^+$ gar keine. Der COSY-TOF-Detektor ist hervorragend geeignet, in diesen Reaktionen bei vollständiger Winkelüberdeckung die Impulse aller Ejektile simultan zu messen. Für diese Hyperonkanäle wurden Daten von COSY-TOF völlig unabhängig von bisherigen Methoden ausgewertet. Wirkungsquerschnitte und differentielle Observablen konnten bestimmt werden.

Die Wirkungsquerschnitte für diese Reaktionen sind durch die Isospinrelationen miteinander verbunden. Die relativen Stärken der Isospinkanäle sind unsicher. Durch den Vergleich der Wirkungsquerschnitte untereinander und mit den theoretischen Vorstellungen sind Aussagen über die relativen Phasen verschiedener Beiträge zum Reaktionsmechanismus möglich.

* gefördert durch BMBF und FZ Jülich

HK 9.7 Fr 18:15 TU MA004

Energy dependence of the $pd \rightarrow {}^3\text{He}\eta'$ production close to threshold. — ●H.-H. ADAM, A. KHOUKAZ, R. SANTO, and A. TÄSCHNER for the COSY-11 collaboration — Institut für Kernphysik, Universität Münster, Germany

Measurements on the near-threshold production of neutral mesons in the reaction channel $pd \rightarrow {}^3\text{He} X^0$ ($X^0 = \eta, \omega, \eta', \phi$) are of general interest for many reasons. This reaction channel might be well suited for rare decay studies of neutral mesons and furthermore, in case of e.g. the η -meson production recent measurements resulted in data that are remarkable for both their strength and energy dependence. The observed rapid decrease of the production amplitude squared $|f|^2$ with increasing excess energy at threshold was found to be dominated by a strong ${}^3\text{He}\text{-}\eta$ final state interaction and the presence of $N^*(1535)$ resonance. In contrast to this, only little is known for the corresponding case of the η' meson production.

New data close to threshold are under evaluation by the COSY-11 collaboration, in order to study the corresponding production amplitude with respect to the absolute scale and a possible deviation from phase-space expectations, similar to the η case. The determination of the excitation function in the near-threshold region is also desirable for studies on the dominant production mechanism and for the confirmation of theoretical predictions.

Newest results on our investigations on the $pd \rightarrow {}^3\text{He} \eta'$ excitation function close to threshold at excess energies up to 10 MeV, using the COSY-11 installation, will be presented. This work is supported by FZ Jülich.

HK 9.8 Fr 18:30 TU MA004

Study of the η meson production in the $\vec{d} + d \rightarrow {}^4\text{He} + \eta$ reaction using the vector and tensor polarised deuteron beam — ●MARIOLA LESIAK for the GEM collaboration — Jagellonian Univ., Cracow, Poland — Inst. für Kernphysik, FZ Jülich

There is a great interest in η -physics in the recent years. Most of the experiments investigate η production in an electromagnetic reaction or in $p+d$ collisions. The existing data for the $\vec{d} + d \rightarrow {}^4\text{He} + \eta$ reaction are so far limited to total cross sections for the beam momentum near threshold. There are many theoretical models describing the η production in $p + d \rightarrow {}^3\text{He} + \eta$ reaction. Kilian and Nann proposed a two step model to describe the $\vec{d} + d \rightarrow {}^4\text{He} + \eta$ reaction. However due to the lack of data the question of the underlying reaction mechanism can not be answered without new measurements.

The measurements of the $\vec{d} + d \rightarrow {}^4\text{He} + \eta$ reaction in a broad beam momentum range from the near threshold region to 3.0 GeV/c is performed at the COSY accelerator in Jülich. We used vector and tensor polarised deuteron beams. The first results of the data analysis will be presented. Ref.: K. Kilian and H. Nann, AIP Conf. Proc. No. 221, p. 185 (1990)

HK 9.9 Fr 18:45 TU MA004

Investigation of $3\pi^0$ final states with the CELSIUS/WASA experiment* — ●C. PAULY¹, F. CAPPELLARO², L. DEMIRÖRS¹, I. KOCH², and W. SCOBEL¹ for the CELSIUS/WASA collaboration — ¹Institut f. Experimentalphysik, Universität Hamburg — ²Dep. of Radiation Sciences, Uppsala University

In the WASA experiment (CELSIUS, Uppsala), decays of the η meson produced in pp and pd reactions are investigated. To obtain the necessary high luminosities a unique target of frozen Hydrogen pellets is used. A 4π CsI calorimeter together with a multilayered forward detector provides the necessary high acceptance and tagging accuracy.

In the last year, data were taken for the pp reaction with a mean luminosity of well above $5 \cdot 10^{30} \text{ cm}^{-2} \text{ s}^{-1}$ and projectile energies of 1360 MeV and 1450 MeV corresponding to excess energies $Q=41$ MeV and 75 MeV, above the η production threshold (1254 MeV). Due to the high geometric acceptance, $3\pi^0 \rightarrow 6\gamma$ final states can be fully reconstructed with all 6 gammas being detected in the calorimeter, and thus providing a very clean event sample. The $\eta \rightarrow 3\pi^0$ channel clearly stands out in the pp missing mass distribution; the η angular distribution will be shown and its Dalitz plot discussed in context with the slope parameter α as a measure of nonuniformity [1]. A cross section estimate for *prompt* $3\pi^0$ production can be deduced by decomposing the pp missing mass distribution of 6γ events based on MC simulations.

[1] W. B. Tippens et al., Phys. Rev. Lett. 87, 192001 (2001)

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