HK 57: Hadron Structure and Spectroscopy II

Time: Wednesday 16:30–19:00 Location: H-ZO 30

HK 57.1 We 16:30 H-ZO 30

Precision spectroscopy of Kaonic Helium-3 $3d \rightarrow 2p$ **X-rays** — •Tomoichi Ishiwatari — Stefan-Meyer-Institut für subatomare Physik, Vienna, Austira

The E17 experiment measures the kaonic helium-3 X-rays using the large area silicon drift detectors (SDDs) in the new kaon beam line at the J-PARC facility in Japan.

The X-ray measurements of kaonic atoms give important information on the low-energy $\bar{K}N$ interaction. In particular, the determination of the shift and width of the kaonic ^{3}He and ^{4}He $2p$ states is a matter of the highest priority on the hadron physics. For example, the Akaishi-Yamazaki theory predicts the existence of the deeply bound kaonic nuclear states. Many experiments to observe such states have been progressed, but the measurements of the shift and width of the kaonic helium $2p$ states are also important values. The theory predicts a possible large shift of up to 10 eV. The first convinced result was obtained in the E570 experiment at KEK, which shows a shift of $+2 \pm 2 \pm 2$ eV. Together with the data on kaonic ^{4}He atoms, the data on kaonic ^{3}He atoms is a very important physical quantity to check the theoretical model.

In this talk, the status of the E17 experiment, in particular the working progress of the SDD system will be reported.

HK 57.2 We 16:45 H-ZO 30

Determination of the hadronic width of the ground state in pionic hydrogen — •Albert Hirtl — Stefan Meyer Institute for Subatomic Physics, Vienna, Austria

In a new high-precision experiment at the Paul Scherrer Institut (PSI), the hadronic shift (ϵ_{1s}) and width (Γ_{1s}) of the ground state of pionic hydrogen, which are directly connected to the pion-nucleon isospin scattering lengths, were remeasured (PSI-Experiment R-98-01). The results can be confronted with recent work of effective field theories defined in the low-energy limit of quantum chromodynamics (QCD), such as, e. g., chiral perturbation theory (ChPT). In addition, Γ_{1s} is connected to the pion-nucleon coupling constant $f_{\pi N}$. A precisely known value for $f_{\pi N}$ allows an accurate determination of the Goldberger-Treiman discrepancy, which constitutes a measure of chiral symmetry breaking. This contribution is mainly devoted to describe a method for an accurate extraction of the hadronic width from the π^-H data.

HK 57.3 We 17:00 H-ZO 30

Kaonic X-ray experiments at DAFNE — •M. Cargnelli[1], M. Bazzi[2], G. Beer[3], L. Bombelli[4], A.M. Bragadireanu[5,2], C. Fiorini[4], T. Frizzi[4], F. Ghio[6], B. Girolami[6], C. Guaraldo[2], R. Hayano[7], M. Iliescu[2,5], T. Ishiwatari[1], M. Iwasaki[8], P. Kienle[9], P. Lechner[10], P. Levi Sandri[2], A. Longoni[4], V. Lucherini[2], J. Marton[1], S. Okada[2], D. Pietreanu[2], T. Ponta[5], A. Romero Vidal[2], A. Scordo[2], He-Xi Shi[7], D.L. Sirghi[2,5], F. Sirghi[2,5], H. Soltau[10], L. Struder[11], H. Tatsuno[7], O. Vazquez Doce[2], E. Widmann[1], and L. Zmeskal[1] — [1]Stefan Meyer Inst., Vienna, Austria — [2]INFN, LNF, Frascati, Italy — [3]Univ. of Victoria, Canada — [4]Politec. di Milano, Italy — [5]IFIN-HH, Bucharest, Romania — [6]INFN Sez. di Roma, Italy — [7]Univ. of Tokyo, Japan — [8]RIKEN, Saitama,Japan — [9]Techn. Univ. München, Germany — [10]PNSensors, München, Germany — [11]MPI f. Extraterr. Phys., Garching, Germany

At the DAFNE collider of LN Frascati we are using the slow kaons to investigate the K-nucleon interaction at rest in hydrogen and deuterium. We are using X-ray spectroscopy of kaonic atoms to measure the strong interaction induced shift and width of the ground state. From these the scattering lengths can be determined, which are essential for the understanding of chiral symmetry breaking in the strangeness sector. Within the project new X-ray detectors were developed: an array of large area silicon drift detectors (SDDs) having excellent energy resolution and good timing which results in a drastic suppression of background. With this technique the measurement of kaonic deuterium X-rays will be feasible for the first time.

HK 57.4 We 17:15 H-ZO 30

Status of kaonic nuclear state search at FOPI using proton induced reaction — •Ken Suzuki[1], Paul Buehler[1], Laura Fabbietti[2], Norbert Herrmann[3], Paul Kienle[1,2], Mladen Kis[4], Yvonne Leifels[4], Johann Marton[1], Eberhard Widmann[1], Toshimitsu Yamazaki[5], and Johann Zmeskal[1] — [1]Stefan Meyer Institute for Subatomic Physics, Austrian Academy of Sciences, Vienna, Austria — [2]Excellence Cluster Universe, Technische Universität München, Garching, Germany — [3]University of Heidelberg, Heidelberg, Germany — [4]Gesellschaft für Schwerionenforschung, Darmstadt, Germany — [5]Department of Physics, University of Tokyo, Tokyo, Japan and RIKEN Nishina Center, Saitama, Japan

We will report an updated status of the kaonic nuclear state (K^-pp) search program using $p + p \rightarrow K^+ + X$ reaction at $T_p = 3$ GeV. A production run takes place in the 2nd half of the year 2009. The report will focus mainly on the hardware development in Vienna and update of simulation which takes into account recent progresses on theory and new experimental observations.

HK 57.5 We 17:30 H-ZO 30

Search for η Mesic Nuclei — •Hartmut Machner — for the GEM Collaboration, Institut für Kernphysik, FZ Jülich, Jülich, Germany

There is a long standing interest whether η mesons can be bound to nuclei. We have performed two completely different experiments to search for such exotic states. First have studied the two nucleon transfer reaction $p+^{27}$Al$\rightarrow^3$He$+\pi^- + p+$X. The experimental conditions were chosen that the ^{3}He emitted under zero degree carries all the beam momentum, and thus the remaining system $\pi^- + p+$X is at rest in the laboratory. The most probable intermediate system is $\eta+^{25}$Al with a second step $\eta+n \rightarrow N^*(1535) \rightarrow \pi^-+p$. A peak corresponding to a binding energy of 13 MeV and a FWHM of 10 MeV was found. The cross section for the peak is 150 pb. When the back-to-back condition for the π^-+p system is released a smooth spectrum is obtained. There are indications that already ^{4}He is heavy enough to bind the η. We studied the $d + d \rightarrow \eta + \alpha$ reaction at $Q = 16.6$ MeV using a tensor polarised beam, by measuring angular distributions of cross section and analysing power. Other groups assumed that the s-wave strength is just the total cross section divided by 4π. This assumption is not appropriate at higher energies. The analysis of the present result shows that a possible p-wave is negligibly small and that there are two d-wave contributions. The s-wave amplitude can be factorised in a production amplitude and a final state enhancement factor depending on the scattering length. We show by comparing the present results with those for ^{3}He that the system is quasi-bound.
Supported in part by FZ Jülich, INB of BMBF and EU (FP6).

HK 57.6 We 17:45 H-ZO 30

Investigation of the ^{3}He η Final State in dp-Reactions at ANKE — •Tobias Rausmann, Paul Goslawski, Alfons Khoukaz, Timo Mersmann, Malte Mielke, Michael Papenbrock, and Alexander Täschner for the ANKE-Collaboration — Institut für Kernphysik, Westfälische Wilhelms-Universität, Münster, Germany

The reaction d+p$\rightarrow^3$He+η has been investigated at the ANKE spectrometer with high precision in a ramped beam near threshold and at higher excess energies of Q = 20, 40 and 60 MeV. This kind of experiment is important for the open question of existance/non existance of η-mesic nuclei, which would be formed in the bound system. The ANKE spectrometer has a full geometrical acceptance and therefore high statistic data on this reaction have been obtained. Total and differential cross sections have been determined to investigate the final state interaction and contributions from higher partial waves. The results of these measurements at higher energies will be presented and compared with the results near threshold and from previous experiments at similiar energies.

Supported by the COSY-FFE program

HK 57.7 We 18:00 H-ZO 30

η photoproduction on ^{3}He : Search for η-mesic nuclei — •Francis Pheron for the A2-Collaboration — Department of Physics, University of Basel

Photoprodution of η-mesons off ^{3}He has been studied via the $\eta \rightarrow 2\gamma$ and $\eta \rightarrow 3\pi^0$ decay modes at the tagged photon beam of the Mainz MAMI accelerator using the combined 4π Crystal Ball/TAPS calorimeter. In a previous experiment, Pfeiffer et al. [1] had reported evidence (although at low statistical significance) for the formation of a quasi-bound η-nucleus state. The present experiment aimed at an improved statistical quality for the structure reported for coherent η

-photoproduction as well as for the π^0-p back-to-back channel. Preliminary results will be presented. Moreover alternative ways for the search of η-mesic nuclei using coherent photoproduction of $\pi^0\eta$-pairs will be discussed.

[1] M.Pfeiffer *et al*, Phys. Rev. Lett. **92**, 252001 (2004)

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HK 57.8 We 18:15 H-ZO 30

Search for the He $-$ η bound states with WASA-at-COSY — •Wojciech Krzemien — Institut für Kernphysik and Jülich Center for Hadron Physics, Forschungszentrum Jülich, D-52425 Jülich, Germany — Jagiellonian University, Cracow, Poland

We conduct a high sensitivity search for the He $-$ η bound state with WASA-at-COSY facility, via measurement of the excitation functions for the $dd \rightarrow {}^3\mathrm{He}p\pi^-$, $pd \rightarrow ppp\pi^-$, $pd \rightarrow pd\pi^0$, reactions where the outgoing nucleon-pion pairs originate from the absorption of the η meson on a nucleon inside the He nucleus. Precise determination of the profile of the expected Breit-Wigner distribution in the excitation curves will allow to determine the binding energy and the width of the He $-$ η bound state. In June 2008, first measurement of the excitation functions for the $dd \rightarrow {}^3\mathrm{He}p\pi^-$ reaction was performed. In the experiment we used slowly ramped COSY deutron beam scanning the range of momenta corresponding to the variation of the excess energy for the Heη system from - 60 MeV up to 20 MeV. Preliminary results from the ongoing analysis will be presented. Supported by BMBF and Wallenberg Foundation.

HK 57.9 We 18:30 H-ZO 30

Search for ω-mesic nuclei — •Karoly Makonyi — II Physikalisches Institut, Heinrich-Buff-Ring 16, 35392 Giessen

The existence and properties of ω-mesic nuclei are being studied with the tagged photon beam facility at the ELSA accelerator in Bonn. The combined setup of the Crystal Barrel and MiniTAPS detector systems, which form a 4π electromagnetic calorimeter, was used for detecting possible decay mode of ω mesic state ($\omega + p \rightarrow N^* \rightarrow \pi^\circ + p$). The recoiling proton of the $\gamma + p \rightarrow \omega + p$ reaction was identified with an aerogel Cherenkov detector and by energy and time information. A first experiment on a carbon target has been performed. The status of the analysis will be presented.

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HK 57.10 We 18:45 H-ZO 30

The search of antikaon nuclear bound states, recent results from FINUDA — •Alessandra Filippi for the FINUDA-Collaboration — INFN Torino, Torino, Italy

New data from the $K^-_{stop}A$ absorption reaction on light nuclei (^{6,7}Li, ^{9}Be and ^{12}C) have been collected by the FINUDA spectrometer, running at the DAΦNE ϕ-factory, in Laboratori Nazionali di Frascati (Italy).

Data on K^- nuclear absorption with the emission of hyperons together with nucleons are scarce. Further experimental studies on their possible correlations are awaited, in order to clarify the mechanism of kaon absorption on multibarionic systems and the possible existence of K^--nucleons aggregates.

According to a few recent theoretical calculations the existence of states where the kaon is bound to two or three nucleons, or even more, is foreseen. These systems are expected to be 20-30 MeV narrow, with binding energies as large as 50-100 MeV. Their observation has been a little elusive so far.

With FINUDA, the possibility to fully reconstruct all the particles coming from the decay of a possible bound kaonic system can be exploited, to study the existence of such states through their invariant mass spectra.

In this talk an overview of the most recent results obtained so far by FINUDA in the study of the existence of K-nuclear bound states will be reported.