HK 30: Hadronenstruktur und -spektroskopie

Zeit: Mittwoch 16:30–18:45 Raum: RW 1

Gruppenbericht HK 30.1 Mi 16:30 RW 1

Hadronic Molecules with Open or Hidden Heavy Flavor — •Martin Cleven[1], Feng-Kun Guo[2], Christoph Hanhart[1], and Ulf-G. Meissner[1,2] — [1]Institute for Advanced Simulation and Jülich Center for Hadron Physics, Institut für Kernphysik, Forschungszentrum Jülich, D-52425 Jülich, Germany — [2]Helmholtz-Institut für Strahlen- und Kernphysik and Bethe Center for Theoretical Physics, Universität Bonn, D-53115 Bonn, Germany

We present techniques to identify molecular states in the spectrum of hadrons. As an example we study the bottomonia states $Z_b(10610)$ and $Z_b(10650)$ which have recently been discovered in the $\Upsilon(5S) \to \pi^+\pi^- h_b$ and $\Upsilon(5S) \to \pi^+\pi^-\Upsilon(nS)$ decays. Their masses are located very close to the $B\bar{B}$ and $B^*\bar{B}^*$ thresholds. It will be shown that the assumption that the $Z_b(10610)$ and $Z_b(10650)$ are $B\bar{B}^* + \text{c.c.}$ and $B^*\bar{B}^*$ bound states, respectively, with very small binding energies is consistent with the data.

HK 30.2 Mi 17:00 RW 1

Precise spectroscopy of pionic atoms at RIKEN — •H. Weick[1], G.P.A. Berg[2], H. Fujioka[3], H. Geissel[1], R.S. Hayano[4], S. Hirenzaki[5], N. Ikeno[5], N. Inabe[6], K. Itahashi[6], S. Itoh[4], D. Kameda[6], T. Kubo[6], H. Matsubara[4], S. Michimasa[4], K. Miki[7], H. Miya[4], M. Nakamura[6], T. Nishi[4], S. Noji[4], S. Ota[4], K. Suzuki[8], H. Takeda[6], K. Todoroki[4], K. Tsukada[9], T. Uesaka[6], and K. Yoshida[6] — [1]GSI, Darmstadt — [2]Notre Dame University, USA — [3]Kyoto University, Japan — [4]University of Tokyo, Japan — [5]Nara Women's University, Japan — [6]RIKEN, Japan — [7]Osaka University, Japan — [8]SMI Vienna, Austria — [9]Tohoku University, Japan

Precision spectroscopy of pionic atoms provides unique information on the isovector πN interaction connected to the reduction of the chiral symmetry breaking at normal nuclear density. Experiments at GSI on Sn isotopes yielded the first quantitative estimation of its reduction to be about 33% compared to that in the vacuum [PRL92(2004)072302].

The pionic atoms are formed on the target nucleus in a Sn(d,^{3}He) reaction. The new BigRIPS separator can accept much more ^{3}He and the RIKEN SRC cyclotron can deliver much higher deuteron beam intensity than in the former experiments, but require a careful dispersion matching in the spectrometer to achieve the resolution despite a much worse momentum spread and position detectors for MHz count rate.

The results of bound states in ^{122}Sn from the 2010 experiment at RIKEN will be discussed with respect to the achievable resolution as well as the necessary calibration steps be explained.

HK 30.3 Mi 17:15 RW 1

Precise spectroscopy of pionic atoms at RIKEN (2) — •K. Suzuki[1], G.P.A. Berg[2], H. Geissel[3], R.S. Hayano[4], S. Hirenzaki[5], N. Ikeno[5], N. Inabe[6], K. Itahashi[6], S. Itoh[4], D. Kameda[6], T. Kubo[6], H. Matsubara[7], H. Michimasa[7], K. Miki[7], H. Miya[7], M. Nakamura[8], T. Nishi[4], S. Noji[7], S. Ota[6], H. Takeda[6], K. Todoroki[4], K. Tsukada[6], T. Uesaka[7], H. Weick[3], and K Yoshida[6] — [1]SMI, Vienna, Austria — [2]JINA, University of Notre Dame, Indiana, USA — [3]GSI, Darmstadt, Germany — [4]Department of Physics, University of Tokyo, Tokyo, Japan — [5]Nara Women's University, Nara, Japan — [6]RIKEN Nishina Center, RIKEN, Saitama, Japan — [7]Center of Nuclear Study, University of Tokyo, Tokyo, Japan — [8]Tokyo Institute of Technology, Tokyo, Japan

Following the successful observation of deeply-bound pionic states at GSI that lead to the precise determination of the s-wave π-nucleus interaction and the deduction of the chiral order parameter at normal nuclear density, we started a new series of experiments at RIKEN, exploiting the high intensity deuteron beam (about 10^{12}/s) from the Superconducting Ring Cyclotron (SRC) and the high acceptance fragment separator (BigRIPS). A pilot experiment in October 2010 using the ^{122}Sn(d, ^{3}He) reaction was successful in establishing the dispersion matching optics and to observe the deeply-bound pionic 1s states in ^{121}Sn.

The results of the experiment will be compared with the previous experiments at GSI and the theoretical prediction, and their possible interpretation and the future outlook of the project will be discussed.

HK 30.4 Mi 17:30 RW 1

Search for ω-mesic states* — •Stefan Friedrich for the CBELSA/TAPS-Collaboration — II. Physikalisches Institut, Universität Gießen, Heinrich-Buff-Ring 16, 35392 Gießen

Experiments searching for the existence of ω-mesic states are presented, using the tagged photon beam 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 the possible ω-mesic states via the $\omega \to \pi^\circ + \gamma$ decay mode. The recoiling proton of the $\gamma + p \to \omega + p$ reaction was identified with an aerogel Cherenkov detector and the forward angle spectrometer MiniTAPS. Two experiments on a carbon target have been performed as well a reference measurement on LH_2. The status of the analysis will be presented.

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HK 30.5 Mi 17:45 RW 1

Search for the ^{4}He $-\,\eta$ bound state with WASA-at-COSY — •Wojciech Krzemien[1], Pawel Moskal[1,2], Jerzy Smyrski[1], and Magdalena Skurzok[1] for the WASA-at-COSY-Collaboration — [1]Jagiellonian University, Krakow, Poland — [2]Institut für Kernphysik, and Jülich Center for Hadron Physics, Forschungszentrum

We conduct a search for the ^{4}He $-\,\eta$ bound state with WASA-at-COSY facility, via a measurement of the excitation functions for the $dd \to {}^3\text{He}p\pi$ reaction, where the outgoing $p-\pi$ pairs originate from the conversion of the η meson on a nucleon inside the He nucleus.

In June, 2008 first measurements of the excitation functions for the $dd \to {}^3\text{He}p\pi$ reaction were performed. In the experiment we used a slowly ramped COSY deutron beam, scanning the range of momenta corresponding to the variation of the excess energy for the $^4He-\eta$ system from - 51 MeV to 22 MeV.The results from the analysis will be presented.

This work has been supported by FFE funds of Forschungszetrum Juelich, grant No 41831803 (COSY-107), by the European Commission under the 7th Framework Programme through the 'Research Infrastructures' action of the 'Capacities' Programme. Call: FP7-INFRASTRUCTURES-2008-1, Grant Agreement N. 227431 and by the Polish Ministry of Science and Higher Education under grants No. 2367/B/H03/2009/37 and 0320/B/H03/2011/40.

HK 30.6 Mi 18:00 RW 1

Scalar tetraquark boundstates in a covariant DSE-BSE approach — •Walter Heupel, Christian Fischer, and Gernot Eichmann — Institut fuer Theoretische Physik I, Justus-Liebig Universitaet Giessen, Deutschland

The bound state of the scalar tetraquark with quantum numbers 0^+ is solved via a Fadeev-like equation. The genuine four-body equation is reduced to an effective two-body problem using a meson-meson/antidiquark-diquark picture. All ingredients of the bound-state equation are calculated in a covariant Dyson-Schwinger/Bethe-Salpeter approach employing a rainbow-ladder truncation together with the Maris-Tandy effective interaction. First results hinting at a bound mass in the 450 MeV region are presented.

HK 30.7 Mi 18:15 RW 1

Search for ppK^- - Status of the FOPI p-p Experiment* — •Robert Münzer für die FOPI-Kollaboration — Excellence Cluster Universe, TU München

The investigation of the kaon-nucleon interaction has been intensified in the last year due to new results on $\Lambda(1405)$ (1) and indications on the existence of the ppK^- bound state (2). The possible creation of the ppK^- has been investigated at the FOPI spectrometer at GSI in proton-proton-collisions at 3.1 GeV. This reaction should favour the formation of the ppK^-, according to some theoretical predictions (3). Due to the RPC detector embedded in the FOPI spectrometer an excellent identification of K^+ has been achieved for this data set. Additionally, a silicon detector system placed close to the target, has been constructed and employed to improve the vertex determination and used as an online trigger for the selection of Lambda hyperons. About $70 \cdot 10^6$ events have been collected after the second level trigger selection.

This contribution will show the status of the ongoing analysis.

*supported by BMBF and Excellence Cluster Universe

(1) J. Siebenson, L. Fabbietti / in press.

(2) T. Yamazaki, M. Maggiora, P. Kienle / PRL 104 / 132502 (2010)
(3) T. Yamazaki, Y. Akaishi / PRC 76 / 045201 (2007)

HK 30.8 Mi 18:30 RW 1

Performance of a TPC with GEM amplification in the FOPI spectrometer.* — •Martin Berger for the GEM-TPC-Collaboration — TU München, Boltzmannstr. 2, 85748 Garching, Germany

A GEM-TPC can exploit the intrinsic suppression of back drifting ions from the amplification stage of the GEM foils to overcome the problem of drift-field distortions in an ungated operation. To explore the possibility of a continuously running TPC (Time Projection Chamber) with GEM (Gas Electron Multiplier) foils instead of MWPC's as amplification stage a prototype detector was built. This prototype with a drift length of 728 mm and a radius of 308 mm and a total of 10254 electronic channels was designed as an upgrade for the FOPI experiment at GSI to improve the secondary vertex resolution especially for K^0_S and Λ and the PID capabilities for $K^+$and K^- fit into the FOPI spectrometer. Several measurements with cosmic rays, ion beams colliding with solid targets [1] and physics run with a π-beam were carried out. During these tests different gain settings, drift fields and gas mixtures have been used to study systematically the response of the chamber. The signal pattern and the spatial resolution extracted by the differential analysis of cosmics data will be discussed in this contribution.

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[1]L. Fabbietti, Nucl. Instr. and Meth. A, 628 204-208 (2011)