HK 35: Hadron Structure and Spectroscopy II

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

Group Report HK 35.1 Tu 16:30 H-ZO 30

Towards polarized Antiprotons — •Frank Rathmann for the PAX-Collaboration — Institut für Kernphysik, Forschungszentrum Jülich, Germany

We present a short overview of the PAX physics case for polarized antiprotons. The recent measurement of the depolarizing pe cross section settled a long–standing controversy about the role of electrons in the polarization buildup of a stored beam by spin-filtering. The depolarization study sheds light on the ep spin–flip cross sections when the target electrons are unpolarized. The experimental finding rules out the practical use of polarized leptons to polarize a beam of antiprotons with present–day technologies. This leaves us with the only proven method to polarize a stored beam in situ, namely spin filtering by the strong interaction. At present, we are lacking a complete quantitative understanding of all underlying processes, therefore the PAX collaboration is aiming at high–precision polarization buildup studies with transverse and longitudinal polarization using stored protons in COSY. The polarized internal target required for these investigations is presently set up to be installed together with a large–acceptance detector system for the determination of target and beam polarizations in a dedicated low β section at COSY. In contrast to the pp system, the experimental basis for predicting the polarization buildup in a stored antiproton beam by spin filtering is practically non–existent. Therefore, it is of high priority to perform, subsequently to the COSY experiments, a series of dedicated spin–filtering experiments using stored antiprotons at the AD ring at CERN.

Group Report HK 35.2 Tu 17:00 H-ZO 30

Exclusive hadronic cross sections from BaBar — •Miriam Fritsch — Institut für Kernphysik, Johannes Gutenberg-Universität Mainz, Germany

Measuring the inclusive hadronic cross section in e^+e^- is of major interest for the determination of the Standard Model prediction of the anomalous magnetic moment of the muon a_μ. The hadronic contribution $a_\mu^{\rm had}$ can be derived from measured total cross sections of exclusive hadronic reactions with the help of a dispersion relation. Decreasing the experimental uncertainties on these channels is of utmost importance to improve the Standard Model prediction. The reaction channel $e^+e^- \to \pi^+\pi^-$ has the biggest impact on the calculation.

This talk presents exclusive hadronic cross sections measured with the technique of Initial State Radiation (ISR). A huge dataset was taken with the BaBar detector at the B-factory PEP-II at SLAC (Stanford, USA), an electron-positron storage ring with fixed CM-energy of 10.58 GeV. Using the ISR method we get access to the energy range from the threshold up to 4.5 GeV. The first preliminary measurement of the $\pi\pi$-channel and other channels important for the the muon anomaly will be presented, as well as the measurement of time-like baryonic form factors.

HK 35.3 Tu 17:30 H-ZO 30

Search for Charmonium Resonances in $\gamma\gamma \to D\bar{D}$ at BaBar — •Torsten Schröder — Institut für Experimentalphysik I, Ruhr-Universität Bochum

We present the search for radially excited charmonium resonances at BaBar. The analysis is based on a data sample of 385 fb^{-1} taken with the BaBar detector at the asymmetric e^+e^- collider PEP-II (SLAC). The large available data set in combination with the instrumentation of the BaBar detector provides excellent conditions for meson spectroscopy.

The masses of the radially excited 2^3P_J-charmonium resonances ($\chi_{cJ}(2P)$) are predicted in the region around 4 GeV/c^2. The Belle collaboration has observed the $Z(3930)$ in two-photon production, which is a candidate for the $\chi_{c2}(2P)$ state. In this presentation, the results of the search for the $Z(3930)$ and other resonances above a mass of 3.7 GeV/c^2 in the process $\gamma\gamma \to Z(3930) \to D\bar{D}$ at BaBar are discussed.

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HK 35.4 Tu 17:45 H-ZO 30

$J/\psi \to 3\gamma$ as an ideal system to study high order QCD corrections — •Jorge Segovia, David R. Entem, and Francisco Fernandez — Universidad de Salamanca, E-37008 Salamanca, Spain

CLEO collaboration has recently measured the branching ratio of the $J/\psi \to 3\gamma$. A signal of 6σ significance was found with branching fraction $B_{3\gamma} = (1.2 \pm 0.3 \pm 0.2) \times 10^{-5}$ [1].

A thorough study of the 1^{--} resonances in the constituent quark model has been done in Ref [2]. In this work not only the meson masses, but electromagnetic, leptonic and strong width decays are succesfully reproduced. Using the model wave function for the J/ψ we obtain $B_{3\gamma} = 3.4 \times 10^{-5}$, almost three times the experimental value.

One loop QCD corrections include five diagrams which take into account vertex, self-energy and ladder, corrections and can be casted in the form $A(\frac{\alpha_s}{\pi})$. Using the value of $\alpha_s(m_c)$ provided by the model, this correction almost cancel the zeroth order approximation giving a theoretical prediction compatible with zero. Two loop corrections are more involved to handle. We made a naive estimation of the contribution at order α_s^2 obtaining a theoretical value of $B_{3\gamma} = 0.6 \times 10^{-5}$.

Our result shows that the precise mesure of the $J/\psi \to 3\gamma$ decay is very important to understand the role of the higher order QCD corrections although more theoretical work has to be done to obtain more accurate results.

[1] CLEO collaboration G. S. Adams *et al*, arXiv:0806.0671[hep-ex].
[2] J. Segovia, D. R. Entem, and F. Fernandez, accepted for publication in Phys. Rev. D.

HK 35.5 Tu 18:00 H-ZO 30

QCD Sum Rules for D and B mesons in nuclear matter — •Thomas Hilger, Ronny Thomas, and Burkhard Kämpfer — FZD, PF 510119, 01314 Dresden

We consider D and B mesons embedded in cold nuclear matter in view of future CBM and PANDA experiments at FAIR. QCD sum rules are applied to pseudoscalar currents with heavy-light quark contents. The impact of various condensates is discussed. The mass splitting of D - D-bar and B - B-bar mesons as a function of the nuclear matter density is quantified: extrapolated to saturation density it is in the order of 60 and 130 MeV, respectively, driven essentially by the condensates <q-adjoint q>, <q-adjoint g sigma G q> and <q-bar q>. The genuine chiral condensate <q-bar q>, amplified by heavy-quark masses, enters the Borel transformed sum rules for the mass splitting beyond linear density dependence. Including strange quark condensates reveals a numerically smaller and opposite effect for the D_s - D_s-bar mass splitting. Weinberg type sum rules for the difference of pseudoscalar and scalar spectral moments are discussed.

HK 35.6 Tu 18:15 H-ZO 30

recent results on mesonic weak decays of Λ-hypernuclei with FINUDA — •stefania bufalino for the FINUDA-Collaboration — INFN Sez. di Torino, via P. Giuria 1, Torino, Italy — Dip. di Fisica Sperimentale, Università di Torino, via P. Giuria, 1 Torino, Italy

Recent results obtained by analyzing the data collected up to now by the FINUDA spectrometer at the DAFNE complex at INFN-LNF in Frascati (Italy) will be presented, in particular the results on the weak π^--mesonic decay channel of p-shell Λ-Hypernuclei will be discussed.

The study is related to the spectroscopy of negative pions spectra emitted in the mesonic weak decay of ${}^{5}_{\Lambda}$He, ${}^{7}_{\Lambda}$Li, ${}^{9}_{\Lambda}$Be, ${}^{11}_{\Lambda}$B and ${}^{15}_{\Lambda}$N following the reaction: $K^-_{stop} + {}^{A}Z \to {}^{A}_{\Lambda}Z + \pi^-$

Exploiting both the target thinness and the good transparency of the FINUDA apparatus, pion momenta as low as 80 MeV/c have been analyzed with a dedicated version of the FINUDA reconstruction code, allowing to investigate for the first time the very low momentum region of negative pion spectra, populated through various mesonic decay mechanisms. Many-body and, when present, also two-body mesonic decay channels have been studied and the relative amplitudes, Γ_{π^--} 2body and Γ_{π^-}–tot, or branching ratios have been measured and will be presented. Comparison with existing experimental data [1] and theoretical predictions [2] will be showed.

[1] S. Kameoka et al., Nucl.Phys. A754 (2005),173. J. Sasao et al., Phys. Lett. B 579 (2004), 258.

[2] T. Motoba and K. Itonaga, Prog. Theor. Phys. Suppl. 117 (1994) 477.

HK 35.7 Tu 18:30 H-ZO 30

study of non mesonic weak decay of Λ– hypernuclei:recent results from FINUDA experiment — •stefania bufalino for

the FINUDA-Collaboration — INFN Sez. di Torino, via P. Giuria 1, Torino, Italy — Dip. di Fisica Sperimentale, Università di Torino, via P. Giuria, 1 Torino, Italy

In free space, a Λ particle decays dominantly as $\Lambda \to N\pi$. In the case of Λ bound in a nucleus, a Λ hypernucleus, Λ is also able to couple with a nucleon as $\Lambda N \to nN$ (non-mesonic weak decay, NMWD). The FINUDA experiment is installed at one of the interaction regions of the DAFNE Φ-factory in Frascati and it is mostly dedicated to the high resolution spectroscopy of Λ hypernuclei and to the study of their weak decays. The aim of this work is to present the recent experimental results obtained from the study of the NMWD of ${}^{5}_{\Lambda}$He, ${}^{7}_{\Lambda}$Li, ${}^{9}_{\Lambda}$Be, ${}^{11}_{\Lambda}$B, ${}^{12}_{\Lambda}$C, ${}^{13}_{\Lambda}$C, ${}^{15}_{\Lambda}$N and ${}^{16}_{\Lambda}$O. Thanks to the excellent capabilities of the FINUDA detector (measurement of the proton spectra with magnetic analysis and production from very thin targets) the spectra feature a precision and low energy threshold (15 MeV) never reached in previous experiments. The measured spectra are quite different from the ones previously reported [1] as well as form the theoretical predictions [2](${}^{5}_{\Lambda}$He and ${}^{12}_{\Lambda}$C). Also the contribution of the Final State Interaction and/or two nucleon absorption processes [3] has been evaluated.

[1] S. Okada et al., PLB 597 (2004), 249. [2] G. Garbarino et al., PRC 69 (2004) 054603. [3] W.M. Alberico and G. Garbarino, Phys. Rep. 369 (2002), 1.

HK 35.8 Tu 18:45 H-ZO 30

Gamma Spectroscopy of Double Hypernuclei at PANDA — •Alicia Sanchez Lorente for the PANDA-Collaboration — Johannes Gutenberg-Universität Mainz, Institut für Kernphysik, D-55099 Germany

In the PANDA experiment at FAIR, bound states of Ξ hypernuclei will be used as a gateway to form double Λ hypernuclei. At PANDA the reactions $\overline{p} + p \to \Xi^{-}\overline{\Xi}^{+}$ and $\overline{p} + n \to \Xi^{-}\overline{\Xi}^{0}$ followed by re-scattering of the Ξ^{-} within the primary target nucleus will be employed to produce low momentum cascade hyperons. After stopping the Ξ^{-} in an external secondary target, the formed Ξ hypernuclei will be converted into double Λ hypernuclei.

For light nuclei even a relatively small excitation energy may be comparable with their binding energy. Thus we assume that the principal mechanism of de-excitation is the explosive decay of the excited nucleus into several smaller clusters. To describe this break-up process we have developed a model which is similar to the famous Fermi model for particle production in nuclear reactions. According to these calculations excited states in double and single hypernuclei are produced with significant probability. In this context, γ-ray spectra have been predicted for the planned PANDA experiment. We will present details of the simulation, the identification procedure of double hypernuclei and the suppression of background. A devoted experimental setup for this physics challenge consisting in a specific target system and a γ-detector will be introduced as well.