

HK 31: Hadron Structure and Spectroscopy V

Time: Tuesday 16:00–17:45

Location: HK-H8

Group Report

HK 31.1 Tue 16:00 HK-H8

Study of resonant states with $c\bar{c}s\bar{s}$ quark content with BaBar and Belle combined data sets — ●ELISABETTA PRENCIPE¹, DMYTRO MELESHKO¹, JENS SOEREN LANGE¹, IHOR MELNYK², JAMES RITMAN³, and ASHISH THAMPI³ — ¹JLU-Giessen, Giessen, Germany — ²TSNU-Kyiv, Kyiv, Ukraine — ³FZJ, Juelich, Germany

The B factories Belle and BaBar have collected huge data sets at the energy in the center of mass of the $\Upsilon(nS)$, $n = 1, 2, 3, 4$, Belle even at that of the $\Upsilon(5S)$, integrating roughly 1.5 ab^{-1} data. This offers unique opportunities to perform spectroscopy studies *e.g.* in radiative decays or ISR analyses. Waiting that the new Belle II experiment will collect the whole planned data sets, 50 ab^{-1} , we have now the opportunity to perform the analysis of invariant mass systems with $c\bar{c}s\bar{s}$ quark content.

A study of resonances with double cs quark content has been conducted with combined BaBar and Belle data sets. We present the results obtained by analyzing the invariant mass systems of $J/\psi\phi$ and $D_s^+ D_s^{*-} J^-$ in different production mechanisms: B decays, B_s decays (Belle) and in the continuum. Interesting results are obtained, some of them confirming the LHCb observations in the $J/\psi\phi$ invariant mass though B decays. Results obtained in the neutral B channel, B_s and in the continuum are original measurements. This program has been approved by DFG as the first spectroscopy analysis with combined data sets from B factories.

HK 31.2 Tue 16:30 HK-H8

Search for the Strange Charmonium-like State Z_{cs} in the Reaction $e^+e^- \rightarrow \eta_c K^* K$ with BESIII — ●FREDERIK WEIDNER¹, NIENKE BALZ¹, HELGE BALZEN¹, JOHANNES BLOMS¹, ANJA BRÜGGEMANN¹, CHRISTOPHER FRITZSCH¹, TITUS HEINIG¹, NILS HÜSKEN², NIKOLAI IN DER WIESCHE¹, LOIS KRÖGER¹, SASCHA LENNARTZ¹, PETER SANDMANN¹, and ALFONS KHOUKAZ¹ for the BESIII-Collaboration — ¹Westfälische Wilhelms-Universität, Münster, Germany — ²Indiana University, Bloomington, USA

In recent years the search for exotic hadrons has identified more and more states which seem to be incompatible with the conventional classification of hadrons as a two or three quark state. However, in most cases the classification of these particles is still inconclusive. One of the areas to search for them is the charmonium region where states have been found which carry isospin or strangeness. These states, called $Z_{c(s)}$, are good candidates for four quark states.

With the newly taken datasets between 4.6 and 4.9 GeV BESIII is searching for $Z_{c(s)}$ states. In this report the search for the Z_{cs} in the decay $Z_{cs} \rightarrow \eta_c K^*$ is presented as this decay is predicted to be one of the main decay channels of the Z_{cs} . Since the η_c meson does not have a golden channel for its reconstruction, in total 14 different decays are considered in a combined fit including three recoiling systems ($K^* K = K^{*+} K^-, K^{*-} K^+$ and $K^{*0} K_s$). In the end the product of the production cross section and the branching ratio will be calculated. This work is funded by the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) - 269952272, 271236083 and 443159800.

HK 31.3 Tue 16:45 HK-H8

Search for exotic states in η_c decays at BESIII — ●ANJA BRÜGGEMANN¹, NIENKE BALZ¹, HELGE BALZEN¹, JOHANNES BLOMS¹, CHRISTOPHER FRITZSCH¹, TITUS HEINIG¹, NILS HÜSKEN², NIKOLAI IN DER WIESCHE¹, LOIS KRÖGER¹, SASCHA LENNARTZ¹, PETER SANDMANN¹, FREDERIK WEIDNER¹, and ALFONS KHOUKAZ¹ for the BESIII-Collaboration — ¹Westfälische Wilhelms-Universität Münster, Germany — ²Indiana University Bloomington, USA

The BESIII detector at the e^+e^- collider BEPCII in Beijing, China, provides the world's largest data sample of the charmonium J/ψ with 10 billion events taken from 2009 to 2019.

Resulting from the radiative J/ψ decay to $\gamma\eta_c$ we analyse the reactions $\eta_c \rightarrow \eta' h\bar{h}$, where the $h\bar{h}$ system represents the $K^+ K^-, K_S^0 K_S^0, \pi^+ \pi^-, \pi^0 \pi^0$ and $\eta\eta$ systems. Since the majority of these η_c decay modes are still unlisted in the particle data group database we determine the corresponding branching ratios. Furthermore, since these mesonic η_c decays constitute a gluon-rich environment they offer the opportunity to investigate possible exotic content within $h\bar{h}$ intermediate states, that lie in the mass region below $2 \text{ GeV}/c^2$, where the lightest glueball is predicted.

Incorporating the analysed η_c decay modes our study is based on a combined partial wave analysis, which gives access to the partial decay widths of contributing resonances decaying to $h\bar{h}$. These widths are directly comparable to theory predictions.

The current status of the analysis will be presented.

This work is funded by DFG - 269952272, 271236083 and 443159800.

HK 31.4 Tue 17:00 HK-H8

Feasibility study of predicted decay channels of a hybrid charmonium candidate with PANDA — ●ÁRON KRIPKÓ, MARKUS MORITZ, and KAI-THOMAS BRINKMANN for the PANDA-Collaboration — II. Physikalisches Institut, Justus Liebig Universität Gießen, 35392 Gießen, Germany

The PANDA experiment will be one of the key experiments at FAIR, which is currently under construction in Darmstadt, Germany. It will be a fixed-target experiment using an antiproton beam with beam momenta between $1.5 \text{ GeV}/c$ and $15 \text{ GeV}/c$.

One of the main goals of PANDA is the detailed investigation of the spectrum of charmonia and charmonium-like hybrids. Compared to the light meson spectrum, the charmonium spectrum is well separated, providing a clean environment to search for non-conventional states. States with exotic J^{PC} can be made in associated formation processes: $p\bar{p} \rightarrow mh$, where m is a light meson (π, η) and h is a charmonium hybrid.

Lattice QCD calculations predict the ground-state hybrid charmonium to be a spin exotic with quantum numbers of $J^{PC} = 1^{-+}$ at a mass of around $4.3 \text{ GeV}/c^2$. Its width is expected to be around $20 \text{ MeV}/c^2$ due to the dynamical suppression of its decay into open charm.

The talk will present a preliminary feasibility study for a measurement of the most probable decay channels of this hybrid charmonium candidate performed with PANDARoot, the common simulation framework for such studies of the PANDA experiment.

This work is supported by HFHF and BMBF.

HK 31.5 Tue 17:15 HK-H8

Pentaquark search in $\Lambda_b^0 \rightarrow \Lambda_c^+ \bar{D}^{*0} K^-$ decays with missing neutrals — ●MINDAUGAS SARPIS — University of Bonn, Bonn, Germany

Charmonium-pentaquarks, P_c , were observed by LHCb in 2015 and 2019 as resonances in the $J/\psi p$ final state from $\Lambda_b \rightarrow J/\psi p K^-$ decays. The nature of these resonances is not yet fully understood, but their proximity to baryon-meson thresholds, like $\Sigma_c \bar{D}^{*0}$, motivate 'molecular' pentaquark models. Several phenomenological studies predict large branching fractions for the decay of $P_c \rightarrow \Lambda_c^+ \bar{D}^{*0}$. The ratio of branching fraction of the exclusive $\Lambda_b^0 \rightarrow \Lambda_c^+ \bar{D}^{*0} K^-$ channel with respect to $\Lambda_b^0 \rightarrow \Lambda_c^+ D_s$ was measured to be $0.569 \pm 0.015 \pm 0.017 \pm 0.016$, where the first uncertainty is statistical, the second systematic, and the third due to the uncertainty on the D branching fractions. Due to the low reconstruction efficiency of π^0 or γ candidates in the decay $\bar{D}^{*0} \rightarrow \bar{D}^0 \pi^0 / \gamma$, a kinematic over-constraint method, Extended Cone Closure, is employed to reconstruct the four-momentum of the \bar{D}^{*0} and be able to study the Dalitz plot of $\Lambda_c^+ \bar{D}^{*0} - \bar{D}^{*0} K^-$. A model independent approach using Legendre moments analysis and the limit setting procedure for the upper limit on P_c yield is presented.

HK 31.6 Tue 17:30 HK-H8

Measuring Generalized Distribution Amplitudes from the $\bar{p}p \rightarrow \gamma\gamma$ and $\bar{p}p \rightarrow \pi^0\gamma$ channels with PANDA at FAIR — ●FAIZA KHALID, STEFAN DIEHL, and KAI-THOMAS BRINKMANN for the PANDA-Collaboration — II. Physikalisches Institut, Justus Liebig Universität Gießen 35392, Germany

The future PANDA experiment at FAIR with the HESR antiproton beam provides unique possibilities to study the 3D nucleon structure with exclusive channels in $\bar{p}p$ annihilation. Among of the channels of interest for the measurement of Generalized Distribution Amplitudes (GDAs) are $\bar{p}p \rightarrow \gamma\gamma$ and $\bar{p}p \rightarrow \pi^0\gamma$. Several simulations at center-of-mass energies squared of, $s = 2.5 \text{ GeV}^2$, $s = 5 \text{ GeV}^2$, $s = 10 \text{ GeV}^2$ and $s = 15 \text{ GeV}^2$, were done for these two signal channels and for their associated background channel(s) to check the feasibility of the measurement. The talk will present the feasibility study for the measurement of the $\cos(\theta)$ dependence of the differential cross-section for $\bar{p}p \rightarrow \pi^0\gamma$ and $\bar{p}p \rightarrow \gamma\gamma$ at different integrated luminosities. The cross

sections have been estimated based on data, which is available in a limited kinematic range from the E760 experiment at Fermilab. Results of count rate estimates and estimates of the expected statistical uncertainty for different integrated luminosity values as well as the

signal to background ratio will be presented. Different event selection cuts have been investigated to optimize the signal to background ratio while keeping a reasonable reconstruction efficiency.

The work is supported by BMBF and HFHF.