HK 29: Hadron Structure and Spectroscopy VI

Time: Friday 14:00–16:00 Location: H3

Group Report HK 29.1 Fri 14:00 H3

The scalar glueball from radiative J/psi decays — •Eberhard Klempt[1], Igor Denisenko[2], Andrey Sarantsev[3], and Ulrike Thoma[1] — [1]Hiskp, Universität Bonn — [2]Jinr, Dubna — [3]Pnpi, Gatchina

Evidence for the scalar glueball is reported. The evidence stems from an analysis of BESIII data on radiative J/Ψ data into $\pi 0\pi 0$, KsKs, $\eta\eta$, and $\Phi\omega$. The coupled-channel analysis is contrained by a large number of further data. The data are described by ten scalar isoscalar mesons, covering the range from f0(500) to f0(2330). Five resonances are interpreted as mainly-singlet states in SU(3), five as mainly-octet states. The mainly-singlet resonances are produced over the full mass range, the production of octet state is limited to the 1500 to 2100 MeV mass range. The peak is interpreted as scalar glueball. Its mass, width and yield are determined.

HK 29.2 Fri 14:30 H3

Reconstruction of complex decay channels using genetic algorithm — •Áron Kripkó, Markus Moritz, and Kai-Thomas Brinkmann for the PANDA-Collaboration — II. Physikalisches Institut, Justus Liebig Universität Gießen, 35392 Gießen, Germany

A common problem in the topic of hadron spectroscopy is the reconstruction of complex decay channels. During the procedure cuts are applied to the properties of the reconstructed candidates along the decay tree with the aim of maximizing the significance. In case of complex decay channels, finding the optimal set of cuts is not obvious.

The application of genetic algorithm to this problem was investigated in PANDARoot. Genetic algorithm is an optimization algorithm inspired by the process of natural selection. PANDARoot is the common simulation framework for feasibility studies of the PANDA experiment.

The talk will present the reconstruction for complex decay channels with 9 final state particles for a predicted hybrid charmonium state ($\bar{\eta}_{c1}$) with $J^{PC} = 1^{-+}$ using genetic algorithm.

This work is supported by GSI, HFHF and BMBF.

HK 29.3 Fri 14:45 H3

Investigation of the decays $\chi_{cJ} \to \eta'\pi^+\pi^-$ and search for the spin exotic meson $\pi_1(1600)$ at BESIII — •Frederik Weidner[1], Nienke Balz[1], Helge Balzen[1], Johannes Bloms[1], Anja Brüggemann[1], Christopher Fritzsch[1], Titus Heinig[1], Nils Hüsken[2], Sascha Lennartz[1], and Alfons Khoukaz[1] — [1]Westfälische Wilhelms-Universität, Münster, Germany — [2]Indiana University, Bloomington, USA

In recent years the search for exotic hadrons has produced more and more states which seem to be incompatible with the conventional classification as a two or three quark state. However, in most of these cases the classification of these particles is inconclusive. An interesting opportunity is given by states with quantum numbers which cannot be produced by the conventional quark model, such as $J^{PC} = 1^{-+}$ in case of the $\pi_1(1600)$, which was seen in multiple experiments.
With the BESIII experiment decays of the χ_{cJ} mesons can be investigated through their production in the radiative decays of the $\psi(2S)$ meson. Here, a large number of events has been recorded by the BESIII detector and additional data taking is ongoing. When considering the decay of these charmonia into three pseudoscalar mesons spin exotic quantum numbers like $J^{PC} = 1^{-+}$ can be accessed. In this talk the current status of the search for the $\pi_1(1600)$ in the decay $\chi_{c2} \to \eta'\pi^+\pi^-$ by the means of a partial wave analysis will be presented.
This work is funded by the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) - 269952272, 271236083 and 443159800.

HK 29.4 Fri 15:00 H3

Determination of the branching ratio of $\eta_c \to \eta' K^+K^-$ and search for exotic content in K^+K^- intermediate states at BESIII — •Anja Brüggemann[1], Nienke Balz[1], Helge Balzen[1], Johannes Bloms[1], Christopher Fritzsch[1], Titus Heinig[1], Nils Hüsken[2], Sascha Lennartz[1], Frederik Weidner[1], and Alfons Khoukaz[1] for the BESIII-Collaboration — [1]Westfälische Wilhelms-Universität Münster, Germany — [2]Indiana 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.

We analyse the reaction $\eta_c \to \eta' K^+K^-$ that results from the radiative J/ψ decay to $\gamma\eta_c$. Until now this η_c decay is still unlisted in the particle data group database. We determine the corresponding branching ratio. Furthermore, it is a common approach to search for exotic states in gluon-rich environments of decaying mesons, like the decaying η_c charmonium into hadrons. Thus, our analysis of $\eta_c \to \eta' K^+K^-$ further offers the opportunity to investigate possible exotic content within intermediate states decaying to K^+K^-, that lie in the mass region below 2 GeV/c^2, where the lightest glueball is predicted.

Our study is based on a partial wave analysis, which gives access to the partial decay widths of contributing K^+K^- resonances. 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 29.5 Fri 15:15 H3

Analysis of Light Isovector Resonances in the Diffractively Produced $\pi^-\pi^-\pi^+$ Final State at COMPASS — •Florian Kaspar for the COMPASS-Collaboration — Technische Universität München, Garching bei München, Deutschland

The COMPASS experiment at CERN can help us to better understand the excitation spectrum of light-quark meson resonances, which consist of up, down, or strange quarks. COMPASS collected a world-leading sample of diffractively produced $\pi^-\pi^-\pi^+$ events. We present our improved analysis of the isovector resonances accessible in this data, where we studied in particular systematic effects in the partial-wave analysis of this final state. In addition, we will discuss our new results focusing on the $J^{PC} = 0^{-+}$ sector that contains the $\pi(1800)$ resonance.

HK 29.6 Fri 15:30 H3

Model Dependence of the $\pi_1(1600)$ signal — •Fabian Krinner — Max Planck Institut für Physik, München, Deutschland

The COMPASS experiment has collected a large data set for diffractive $\pi^-\pi^+\pi^-$ production. We use this data set to investigate contradictions found by previous partial-wave analyses of the same channel for the signal of a spin-exotic partial wave with spin, parity and charge conjugation quantum numbers 1^{-+}. We find a strong dependence of the signal for this wave on the used analysis model to cause the observed contradictions. We construct a large analysis model tuned to minimize such model-dependencies and study the robustness of this model with the freed-isobar partial-wave analysis method.

HK 29.7 Fri 15:45 H3

Fit of the $a_1(1420)$ as a triangle singularity — •Mathias Wagner and Bernhard Ketzer — HISKP, Uni Bonn, Germany

In the recent past several new particle candidates were found which do not fit into the simple constituent-quark models for mesons and baryons. Different concepts were introduced in order to find an explanation for these exotic states. One of them is a rescattering effect. Here, triangle diagrams can produce resonance-like signals, both in the intensity and the relative phase of the corresponding partial wave.

One prominent example is the $a_1(1420)$ signal, observed by the COMPASS experiment in the $J^{PC} = 1^{++}$ partial wave decaying to $f_0(980)\pi$ in a P-wave.

We present the fit results of the finalized model, where we properly include all involved spins via a dispersive integral over a partial wave projection of the $K\bar{K}\pi$ final state onto the 3π final state. It shows that the $a_1(1420)$ can be fully explained by the decay of the ground-state $a_1(1260)$ into $K^*\bar{K}$ and subsequent rescattering through a triangle singularity into the observed final state $f_0(980)\pi$ without the need of a new genuine a_1 resonance. The effect of the triangle singularity, which is expected to be present, is sufficient to explain the observation. (accepted PRL)