HK 10: Hadron Structure and Spectroscopy I

Time: Monday 16:45–18:15 Location: HBR 62: EG 18

Group Report HK 10.1 Mon 16:45 HBR 62: EG 18

Spectroscopy highlights from COMPASS and prospects for the new AMBER experiment — •Henri Pekeler for the COMPASS-Collaboration — Universität Bonn, Helmholtz-Institut für Strahlen- und Kernphysik, Bonn, Germany

The COMPASS experiment, located at the M2 beam line at CERN, had a very rich hadron-physics program for the last two decades. Within this talk, we will focus on the data, for diffractive dissociation, i.e. events of the type $\pi^- p \to X^- p$ or $K^- p \to X^- p$, providing the world's largest data sets in various final states.

The data sets are decomposed into individual J^{PC} contributions by partial-wave analyses employing many novel tools developed by COMPASS. The results provide a full picture of light π_J and a_J mesons up to masses of about 2.5 GeV, including candidates for exotic mesons. Highlights include the solution of the long-standing puzzle of the light spin-exotic state with $J^{PC} = 1^{-+}$, the precise determination of resonance parameters of many states, as well as several signals for new states, some not fitting model expectations. We will also present first results for the strange meson sector, including a significant signal for a supernumerous state with $J^P = 0^-$.

The successor experiment of COMPASS, AMBER, started data taking for its phase 1 in 2023. In phase 2, several new measurements are planned with a high-intensity kaon beam, including precision spectroscopy of K_J and K_J^* states, where no new data has been available for more than 20 years. We will present first studies about improvements of the experimental setup. Supported by BMBF.

HK 10.2 Mon 17:15 HBR 62: EG 18

Investigation of the decays $\chi_{cJ} \to \eta'\pi^+\pi^-$ and search for the spin exotic meson $\pi_1(1600)$ at BESIII — •Frederik Weidner, Salleh Ahmed, Anja Brüggemann, Nikolai in der Wiesche, and Alfons Khoukaz — Universität Münster, Münster, Germany

In recent years the search for exotic hadrons has uncovered more and more states which seem to be incompatible with the conventional classification as two or three quark states. Some of these have quantum numbers, which cannot be produced by the conventional quark model, such as $J^{PC} = 1^{-+}$ in case of the $\pi_1(1600)$, which is discussed to be in a hybrid multiplet together with the $\eta_1(1855)$.
With the BESIII experiment decays of the χ_{cJ} mesons can be investigated through their production in radiative decays of the $\psi(2S)$ meson. When considering the decay of these charmonia into three pseudoscalar mesons, spin exotic quantum numbers like $J^{PC} = 1^{-+}$ can be accessed. Additionally, precision measurements of branching ratios of the χ_{cJ} states can help solidify our understanding of charmonia and, therefore, of the transition region between perturbative and non-perturbative QCD. In this talk the search for the $\pi_1(1600)$ in the decay $\chi_{c2} \to \eta'\pi^+\pi^-$ using a partial wave analysis, and the determination of branching ratios of $\chi_{cJ} \to \eta'\pi^+\pi^-$, will be presented.
This work is supported by the German Research Foundation under project number 443159800 and GRK 2149/2 and by the Ministry for Culture and Science of the State North Rhine-Westphalia under funding code NW21-024-E.

HK 10.3 Mon 17:30 HBR 62: EG 18

Search for the Lightest Scalar Glueball via the Reactions $\psi(2S) \to \phi +$ Light Mesons at BESIII — •Nikolai in der Wiesche, Frederik Weidner, Salleh Ahmed, Anja Brüggemann, Tessa Bertelsmeier, Johannes Bloms, Peter Sandmann, and Alfons Khoukaz — Universität Münster, Münster, Germany

The self-interaction of gluons is one of the most fundamental feature of QCD. It implies that there should be bound states of gluons, so-called glueballs, which would provide an excellent probe of the strong interaction since they do not couple to any other standard model interaction. Theoretical calculations predict that the lightest glueball with quantum number $J^{PC} = 0^{++}$ has a mass between 1.6 GeV and 1.7 GeV. The three experimentally observed isoscalar 0^{++} states $f_0(1370)$, $f_0(1500)$ and $f_0(1710)$ are strong contenders for containing admixtures of the scalar glueball. However, they could also fit into a scalar meson nonet, making their classification very controversial.
In this talk, the current state of the coupled channel analysis of the reactions $\psi(2S) \to \phi + \pi\pi, 4\pi, K\bar{K}$ and $\eta\eta$ will be presented, using the world's largest $\psi(2S)$ data set obtained at BESIII. In this analysis, the properties of the f_0 states, which are produced as intermediate resonances in the recoil systems of the ϕ meson, will be extracted using partial wave analyses.
This work is funded by the German Research Foundation under the project GRK 2149/2 and by the Ministry for Culture and Science of the State North Rhine-Westphalia under funding code NW21-024-E.

HK 10.4 Mon 17:45 HBR 62: EG 18

Partial-Wave Analysis of the $\omega\pi\pi$ Final State at COMPASS — •Philipp Haas for the COMPASS-Collaboration — Technische Universität München

The Constituent Quark model describes mesons as $q\bar{q}'$ states. However, QCD allows configurations beyond $q\bar{q}'$ states, so-called exotic mesons. One example of an exotic configuration are hybrid mesons, where in addition to $q\bar{q}'$ the gluonic field contributes to the total quantum numbers of the state. Lattice QCD predicts the lightest hybrid meson with quantum numbers $J^{PC} = 1^{-+}$ around 1.6 GeV/c^2. This state was found and established at the COMPASS experiment at CERN as $\pi_1(1600)$ in its decay to the $\eta^{(\prime)}\pi$ and 3π final states. However, lattice QCD predicts $b_1(1235)\pi$ as dominant decay channel of $\pi_1(1600)$.

COMPASS acquired the so-far world's largest sample of this decay in the diffractive scattering reaction $\pi^- + p \to \omega(782)\pi^-\pi^0 + p$. We perform a partial-wave analysis of this process, including modeling the $\omega(782) \to 3\pi$ decay to allow better signal separations from possible backgrounds in our sample. In this talk we present the current status of the analysis. Among other resonance-like signals, we find a signal with quantum numbers $J^{PC} = 1^{-+}$ decaying to $b_1(1235)\pi$ around 1.7 GeV/c^2.

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HK 10.5 Mon 18:00 HBR 62: EG 18

Analysis of the radiative decay $J/\psi \to \gamma\phi\omega$ at BESIII — •Orestis Afedulidis — Ruhr-Universität Bochum, Bochum, Deutschland

Exotic mesons like glueballs and hybrids are predicted to be copiously produced in radiative J/ψ decays. A good reaction to discover such states is the doubly OZI suppressed decay $J/\psi \to \gamma\omega\phi$.
This talk covers the analysis of this process, using the worlds largest data sample of $\approx 10^{10}$ J/ψ events collected with the BESIII detector. Preliminary results of the data selection, background studies and a partial wave analysis will be shown.
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