HK 13: Hadron Structure and Spectroscopy III

Time: Tuesday 17:00–18:15 Location: J-HS A

Group Report HK 13.1 Tue 17:00 J-HS A

Investigating the scalar meson sector with BESIII — •Nils Hüsken, Johannes Bloms, Anja Brüggemann, Alfons Khoukaz, Sascha Lennartz, and Frederik Weidner — Westfälische Wilhelms-Universität Münster, Germany

The scalar meson sector has long been subject of intense speculation. Lattice QCD calculations predict the lightest glueball to share its quantum numbers with the scalar mesons. From various experiments, five scalars with a mass below 2 GeV/c^2 have been established, the $f_0(500)$, $f_0(980)$, $f_0(1370)$, $f_0(1500)$ and $f_0(1710)$. While it is clear that at least one of these states is supernumerary with respect to naive quark model expectations, there is no consensus on the nature of these scalar mesons yet. With the BESIII experiment, scalar mesons can be studied in different production and decay mechanisms. Using the world-record 10^{10} J/ψ mesons directly produced in e^+e^- annihilation with BESIII, scalar mesons can be studied both in direct decays of the J/ψ, for example in $J/\psi \to \phi K\bar{K}$, as well as in η_c decays like $\eta_c \to \eta' K\bar{K}$. While the former channel gives access to scalar states with a strong $s\bar{s}$ component, η_c decays involving scalar resonances might potentially allow to study $gg - q\bar{q}$ mixing. In addition, the BESIII high statistics datasets at center-of-mass energies between 3.7 GeV and 4.6 GeV dedicated to the search for new, heavy resonances in the charmonium region are used to explore potential couplings of the XYZ states to the light (scalar) meson sector. The current status of these analyses being performed in the Münster BESIII group will be discussed. This project has received funding from the DFG (FOR2359 and GRK2149).

HK 13.2 Tue 17:30 J-HS A

Untersuchung von J/ψ-Zerfällen mit dem BESIII-Experiment — •Orestis Afedulidis — Ruhr-Universität Bochum - Institut für Experimentalphysik I, 44801 Bochum

Das BESIII-Experiment, welches am symmetrischen Elektron-Positron-Speicherring BEPCII am Institute of High Energy Physics (IHEP) in Peking mit Schwerpunktsenergien von $\sqrt{s} = (2-4,6)$ GeV, betrieben wird, hat bis heute etwa 10^{10} J/ψ-Ereignisse aufgezeichnet. Dies ist der zur Zeit größte Datensatz, bei der die J/ψ-Resonanz in Formation erzeugt wurde. Aufgrund der großen Anzahl von Ereignissen kann dieser Datensatz zur präzisen Vermessung von Verzweigungsverhältnissen benutzt werden.

Untersucht wird der Zerfall $J/\psi \to K^+K^-\gamma\gamma$ mit den möglichen Zwischenresonanzen π^0, η und η' im $\gamma\gamma$-System. Darüber hinaus können weitere Resonanzen – z.B. angeregte Pseudoskalare – im $\gamma\gamma$-System gesucht werden, um weitere Erkenntnisse über die Struktur dieser Resonanzen zu erhalten. Vorgestellt werden erste Ergebnisse dieser Studie.

Gefördert durch die DFG (FOR 2359)

HK 13.3 Tue 17:45 J-HS A

Observation of the hypertriton in pp collisions with ALICE at the LHC — •Michael Hartung — Institut für Kernphysik, Goethe-Universität, Frankfurt, Germany

The hypertriton lifetime represents one of the open key questions of hypernuclear physics. The separation energy of the Λ inside the hypertriton is only 130 keV and this implies a small modification of the Λ wave function inside the nucleus, hence the lifetime of the hypertriton is expected to be close to that of the free Λ. The average value of the results obtained with different experimental techniques was found to be significantly lower than the theoretical prediction and this disagreement is referred to as the hypertriton lifetime puzzle. Significant hypertriton yields have only been measured in Pb-Pb collisions at the LHC. Due to its weak decay, the hypertriton can be reconstructed from its daughter products, e.g. the charged two-body decay channel ${}^3_\Lambda\mathrm{H} \to {}^3\mathrm{He} + \pi^-$. In order to be able to measure these rare (anti-) nuclei also in pp collisions, it is essential to increase the statistics by employing a dedicated trigger on nuclei. The Transition Radiation Detector of ALICE offers unique trigger capabilities. In combination with the excellent particle identification through the energy-loss measurement in the Time Projection Chamber and the capabilities to separate primary particles from those from secondary decays, provided by the Inner Tracking System, it is possible to identify the hypertriton in pp collisions. In this talk, the first observation of the hypertriton in pp collisions is presented as well as the current status of the lifetime measurement. Supported by BMBF and the Helmholtz Association.

HK 13.4 Tue 18:00 J-HS A

Final fit of the $a_1(1420)$ as a triangle singularity — •Mathias Wagner[1], Mikhail Mikhasenko[2], and Bernhard Ketzer[1] for the COMPASS-Collaboration — [1]Universität Bonn, Helmholtz-Institut für Strahlen- und Kernphysik, 53115 Bonn, Germany — [2]CERN, Geneva, Switzerland

In the recent past several new particle candidates (e.g. the X, Y, Z states in the charmed sector) 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 in the three-particle system. Here, triangle diagrams can produce resonance-like signals.

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.

By coupling the $K\bar{K}\pi$ and the 3π final states we obtain a first order approximation to the Khuri-Treiman equation for the 1^{++} sector. We present the fit results of the finalized model, where we properly include all involved spins via a dispersion integral over a partial wave projection of the $K\bar{K}\pi$ final state onto the 3π final state, using a general πK P-wave amplitude.

Many systematic studies were performed, including a bootstrap analysis and an investigation of other contributions to the decay amplitude. A comparison to a fit with a genuine-resonance model is done for all cases.

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