HK 23: Hadron Structure and Spectroscopy IV

Zeit: Dienstag 16:30–18:15 Raum: S1/01 A5

Gruppenbericht HK 23.1 Di 16:30 S1/01 A5

Light Meson Spectroscopy in Electron-Positron and Antiproton-Proton Annihilations — •Malte Albrecht, Bertram Kopf, Marc Pelizäus, Julian Pychy, Fritz-Herbert Heinsius, and Ulrich Wiedner — Inst. f. Experimentalphysik I, Ruhr-Universität Bochum

QCD predicts exotic bound states, such as states with gluonic degrees of freedom like glueballs or hybrids in the mass region between 1 and 2 GeV/c^2. Especially radiative decays of charmonia and the antiproton-proton annihilation process provide an excellent laboratory to study the light meson sector, since both are referred to as 'gluon-rich' processes.

Due to the presence of many broad and often overlapping states in the light meson sector, the properties of the contributing resonances can mostly only be accessed via a full partial wave analysis.

Recent results from analyses of radiative charmonium decays using data from the BESIII experiment at the symmetric electron-positron collider BEPCII in Beijing, as well as the Crystal Barrel/LEAR experiment are presented. Parts of the analyses from both annihilation processes are performed utilizing the user-friendly partial wave analysis software PAWIAN, which is being developed in Bochum.

Apart from a deeper understanding of the light meson spectrum and the existence of possible exotic states, the analyses are an important step towards the analysis of data from the upcoming PANDA experiment at FAIR.

Supported by the DFG

HK 23.2 Di 17:00 S1/01 A5

Model Selection in Partial-Wave Decomposition — •Karl Bicker, Suh-Urk Chung, Oliver Drotleff, Jan Friedrich, Boris Grube, Fabian Krinner, Stephan Paul, Dimitry Ryabchikov, and Sebastian Uhl — Physik Department, E18, Technische Universität München

Model selection in the context of partial-wave decomposition of data from diffractive dissociation reactions is a daunting task. Due to the large number of possible waves which are conceivable to contribute to the measured distributions, an almost infinite number of models can be constructed. We will present a method which uses a maximum-likelihood estimation together with a prior function to select an appropriate set of partial waves that describes the data at hand. This work is supported by BMBF, MLL München and the DFG Cluster of Excellence Exc153.

HK 23.3 Di 17:15 S1/01 A5

Helizitätsformalismus im Amplitudenanalyse-Framework ComPWA — •Stefan Pflüger[1], Mathias Michel[1], Florian Feldbauer[1,2], Miriam Fritsch[1,2], Klaus Götzen[1,3], Wolfgang Gradl[2], Frank Nerling[1,3], Klaus Peters[1,3] und Peter Weidenkaff[2] — [1]Helmholtz Institut Mainz — [2]Johannes Gutenberg Universität Mainz — [3]GSI Helmholtzzentrum Darmstadt

Die Suche nach neuen konventionellen sowie exotischen hadronischen Zuständen, wie z.B. Hybriden oder Gluebällen, erfordert die Identifizierung möglicher Kandidaten und die eindeutige Einordnung bereits bekannter Zustände. Dazu wird in einem Großteil der Analysen eine Amplitudenanalyse (PWA) benötigt. Zu diesem Zweck wird das neue, flexible und effiziente PWA-Framework ComPWA entwickelt. Es ist modular gestaltet, was es erlaubt, problemlos weitere Modelle und Formalismen hinzuzufügen, wie auch gleichzeitig mehrere Datensätze (auch verschiedener Experimente) simultan zu analysieren. Außerdem werden verschiedene Minimierungs- und Bewertungsstrategien zur Verfügung gestellt. Dabei wird die Software fortwährend mit Daten laufender Experimente wie z.B. BESIII validiert und getestet. In diesem Vortrag wird das neu entwickelte Helizitätsamplituden-Modul vorgestellt, welches unter Verwendung eines Expertensystems die automatische Konstruktion und Berechnung von Helizitätsamplituden erlaubt.

HK 23.4 Di 17:30 S1/01 A5

Rescattering effects for a three-body final state — •Mikhail Mikhasenko and Bernhard Ketzer — Universität Bonn, Helmholtz-Institut für Strahlen- und Kernphysik, Bonn, Germany

The isobar model is a phenomenological approach commonly used to describe multiparticle final states as sequential two-body decays into intermediate resonances (isobars), which then decay into the final state observed in the experiment without further interaction. We stress that in presence of a significant inelasticity in the reaction, strong effects of rescattering appear which can produce a resonance-like enhancement in the subchannels as well as in the three body invariant mass. The Khury-Treiman equations inspired by unitarity and analyticity are a powerful tool to investigate the influence of rescattering. We show that the leading order triangle diagram already gives a good approximation to the complete rescattering series. We discuss the effect of rescattering for several examples: the 3π final state related to the $a_1(1420)$ observed by COMPASS and VES experiments, $J/\Psi pK$ related to the recently observed pentaquark candidates and $J/\Psi\pi\pi$ related to exotic XYZ states. The work is supported by BMBF.

HK 23.5 Di 17:45 S1/01 A5

Extraction of the amplitude of the $\pi^+\pi^-$ subsystem in diffractively produced $\pi^-\pi^+\pi^-$ at COMPASS — •Fabian Krinner — Physik-Department E18, Technische Universität München

The two-stage Compass spectrometer has collected a huge data set of tens of millions of events for the channel $\pi^- p \to \pi^-\pi^+\pi^- p$. Therefore, spectroscopy analyses in this channel are dominated by systematic effects. The established method to analyze these data is Partial-Wave Analysis (PWA). For multi-particle final states PWA usually assumes subsequent two-particle decays, i.e. in case of $\pi^-\pi^+\pi^-$ one additional intermediate state which decays into $\pi^+\pi^-$. Fixed mass shapes for this intermediate state, the so-called isobar, have to be assumed. These shapes, which in the most simple case may be given by a Breit-Wigner amplitude, have to be put into the analysis beforehand and therefore may introduce a model dependence leading to increased systematic uncertainties. We present a first analysis of diffractively produced $\pi^-\pi^+\pi^-$ events using a new method, which instead allows to extract binned isobar amplitudes directly from the data in a more model-independent way.

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HK 23.6 Di 18:00 S1/01 A5

Modeling of non-resonant Deck-like contributions in diffractive-dissociation reactions at COMPASS — •Dmitri Rybachikov — Physik-Department E18, Technische Universität München

COMPASS is a multi-purpose fixed-target experiment at the CERN Super Proton Synchrotron aimed at studying the structure and spectrum of hadrons. The spectrum of light-meson resonances is studied in diffractive-dissociation reactions using a 190 GeV/c π^- beam. The flagship channel is the $\pi^-\pi^+\pi^-$ final state, for which COMPASS has recorded the currently largest data sample. The extraction of resonances from these data is limited mainly by the understanding of non-resonant components. One of the main non-resonant production mechanisms in this reaction is the Deck effect. We will present studies of a model of the Deck process and compare it to COMPASS data.

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