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Light-Meson Spectroscopy at COMPASS

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The COMPASS experiment at the CERN SPS is a multi-purpose fixed-target experiment designed to study the strong interaction. Using a 190 GeV/c hadron beam, COMPASS has recorded the world's largest data set of diffractive scattering reactions. These data provide a unique opportunity to study the excitation spectrum of non-strange and strange light mesons with masses up to about 2.5 GeV/c^2, as well as to investigate exotic states beyond the constituent quark model. This is achieved by performing comprehensive partial-wave analyzes of various final states, which decompose the data into amplitudes with well-defined quantum numbers and allow for the extraction of resonance parameters of the contributing mesonic states.
Of special interest is the exotic $\pi_1(1600)$, the lightest hybrid meson candidate with $J^{PC} = 1^{-+}$, which has been observed at COMPASS in all predicted dominant decay channels, including $\eta'\pi^-$ and $f_1(1285)\pi^-$, both observed in the $\pi^-\pi^-\pi^+\eta$ final state, and $b_1(1235)\pi^-$, observed in the $\omega\pi^-\pi^0$ final state. The $K^0_S K^-$ final state allows for a precise measurement of a_J states with even spins J and enables an exclusive study of these mesons at high masses, which is a hitherto unexplored region. We further present the analysis of the $K^-\pi^-\pi^+$ final state, representing the most comprehensive measurement of the strange-meson spectrum to date, revealing the first evidence for a supernumerary $J^P = 0^-$ state.
In addition, we discuss the analysis of the non-resonant double-Regge exchange process using $\eta^{(\prime)}\pi$ data in the high-mass region. It is the first event-based likelihood fit to the full COMPASS data set in this regime and improves our understanding of non-resonant production mechanisms in light-meson spectroscopy.

Collaboration

COMPASS

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