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High energy $\pi\eta^{(\prime)}$ production and the double Regge exchange

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The $\pi^- p \to \pi^- \eta p$ and $\pi^- p \to \pi^- \eta' p$ reactions were recently studied by the COMPASS collaboration at CERN. The analysis has shown that for high energies the $\pi\eta^{(\prime)}$ system is produced in two kinematic regimes. In these regimes the laboratory frame direction of $\eta^{(\prime)}$ is either forward or backward. The Gottfried-Jackson frame analysis of the polar angle distribution revealed the characteristic forward-backward asymmetry in the polar angle, with the asymmetry being stronger for the $\pi\eta'$ system. We describe these processes in terms of double Regge exchange, where both meson-meson and meson-baryon invariant masses are large. The multi-Regge processes had been extensively studied in the seventies and the elegant mathematical formulation of the production amplitudes was developed. Nevertheless, the phenomenological status of the multi Regge approach was still not clear even in the simplest case of three particles in the final state. We have shown that applying the double Regge exchange and taking into account the leading 2^{++} Regge trajectories, we are able to explain the forward-backward asymmetry. We have also identified the dominant amplitudes and indicated that the observed asymmetry originates from the interference of the even and odd partial waves (with the latter being exotic). Especially the impact of the strongest odd wave, namely the $P-$ wave, is interesting through its direct relation to the production of the putative π_1 hybrid meson. The high energy amplitudes can be formally related to the production of exotic resonances through the Finite Energy Sum Rules.

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