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Unitarization Schemes at High Energies

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Content

The implementation of unitarity in high-energy hadronic scattering remains a fundamental problem in both phenomenological and theoretical analyses. We examine two distinct unitarization frameworks, the eikonal and the U-matrix approaches, which are employed to restore S-matrix unitarity in the nonperturbative regime. Although both are based on the same unitarity condition, they exhibit different analytic structures, asymptotic behaviors, and relations between the input (Born) amplitude and the physical scattering amplitude. We discuss how these schemes constrain the energy dependence of total and elastic cross sections, their implications for the approach to the black disk limit, and their sensitivity to the underlying dynamical input. Special emphasis is placed on possible phenomenological signatures that could distinguish between the eikonal and U-matrix unitarization schemes in present and forthcoming high-energy data.

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