Elastic and Total Cross-Section Measurements by TOTEM

Tuesday, 9 April 2019 11:45 (20 minutes)

The TOTEM experiment at the LHC has measured proton-proton elastic scattering in dedicated runs at √s = 2.76, 7, 8 and 13 TeV centre-of-mass LHC energies. The proton-proton total cross-section has been derived for each energy using a luminosity independent method. TOTEM has excluded a purely exponential differential cross-section for elastic proton-proton scattering with significance greater than 7 σ in the |t| range from 0.027 to 0.2 GeV² at √s = 8 TeV. The ρ parameter has been measured at √s = 8 TeV via the Coulomb-nuclear interference, and was found to be ρ = 0.12 ± 0.03. The measurement has been repeated at 13 TeV and the result ρ = 0.09 ± 0.01 probes the existence of a colourless three-gluon bound state. The measured 2.76 TeV differential cross-section by TOTEM provides evidence for the colourless 3-gluon bound state, when compared to the D0 experiment ppbar result at 1.96 TeV (neglecting the small energy difference between TOTEM and D0).

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Session Classification: WG2: Small-x and Diffraction

Track Classification: WG2: Low-x and Diffraction