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Optimizing the Signal of Odderon

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Recently, a statistically significant signal for the observation of the odderon has been published in EPJ C, that reported an Odderon signal of at least 6.26 sigma, based on a scaling analysis of the differential cross-sections of elastic pp and pbarp scattering in the TeV energy range [1]. The D0 and TOTEM collaborations reported an at least 5.2 sigma Odderon signal from a comparison of the pp and pbarp differential cross-sections in a kinematic range limited to the diffractive interference region, combined with the measurement of the pp total cross-sections and the real-to imaginary ratio rho at 13 TeV [2]. We have analyzed the similarities and the differences of these two approaches and propose here a novel gating method that allows to separate the Odderon signal from its background. This method is utilized to determine the domain of validity of the scaling behaviour of the differential cross-section at the TeV energy range, and to determine the signal range optimalized significance of the Odderon observation. We find that the optimized statistical significance for the Odderon observation on the TeV energy scale, based on published differential cross-section data of elastic pp and pbarp scattering, is at least 6.33 sigma, improving on both the D0-TOTEM estimate and our earlier results of 6.26 sigma. Outside this optimal Odderon signal window, the background of the Odderon signal is found to agree between pp and pbarp within 1.7 sigma.

[1] T. Csörgő, T. Novák, R. Pasechnik, A. Ster and I. Szanyi:
Evidence of Odderon-exchange from scaling properties of elastic scattering at TeV energies.
Eur. Phys. J. C 81, 180 (2021). https://doi.org/10.1140/epjc/s10052-021-08867-6

[2] D0 and TOTEM Collaborations, V. M. Abazov et al. :
Comparison of pp and pbarp differential elastic cross sections and observation of the exchange of a colorless C-odd gluonic compound
e-Print: 2012.03981 [hep-ex], accepted for a publication in the Physical Review Letters on June 10, 2021

Preferred track

Forward & Diffractive Physics

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