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Odderon observation from elastic pp and ppbar difference and pp forward scattering: an update with answers to questions and objections

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The pp elastic cross section at 1.96 TeV, obtained from a data-driven extrapolation of the cross sections measured by TOTEM at 2.76, 7, 8, and 13 TeV, have been compared with the D0 ppbar elastic cross section at 1.96 TeV in the region of the diffractive minimum and the second maximum of the pp cross section [1]. The two 1.96 TeV data sets have been found disagree at the 3.4σ level and thus provides evidence for Odderon exchange. These results have been combined with a TOTEM analysis of Odderon exchange based on the total cross section and the ρ parameter in pp elastic scattering [2]. The combined significance is larger than 5σ and interpreted as the first observation of Odderon exchange.

In this presentation, a comprehensive list of questions and objections raised to the published analysis are answered and supplementary material is provided [3]. These demonstrate that the methods and assumptions made for the extrapolation of the pp elastic cross section to 1.96 TeV and its comparison to the D0 measurement in ppbar are valid and reasonable, even conservative on key points, leading in fact to an conservative estimate for the significance. Same is true for the methods and choices made by TOTEM for the total cross section and the ρ measurements.

[1] V.M. Abazov et al. (D0 and TOTEM Collaborations), Odderon Exchange from Elastic Scattering Differences between pp and ppbar Data at 1.96 TeV and from pp Forward Scattering Measurements, Phys. Rev. Lett. 127, 062003 (2021).
[2] G. Antchev et al. (TOTEM Collaboration), First determination of the ρ parameter at √s = 13 TeV: probing the existence of a colourless C-odd three-gluon compound state, Eur. Phys. J. C. 79, 785 (2019).
[3] K. Österberg on behalf of D0 and TOTEM Collaborations, Odderon observation: explanations and answers to questions/objections regarding the PRL publication, in Proc. of Low-x Workshop 2021, arXiv:2202.03724 (2022).

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