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RESEARCH TOTEM AND DØ ANNOUNCE ODDERON OBSERVATION

The scientific collaborations TOTEM at CERN, with a major INFN participation, and DØ at Fermilab have announced the observation of the odderon, an elusive state of matter formed by three

fundamental particles called gluons and predicted almost 50 years ago. The outcome was observed with CERN's LHC particle accelerator, where the TOTEM experiment is located, and Fermilab's Tevatron, where the DØ experiment is installed. The presentation of the work at CERN follows the joint publication in December 2020 of a preprint by CERN and Fermilab.

The states comprising two, three or more gluons are usually called glueballs and are peculiar objects consisting only of the strong force mediators (the gluons). The advent of quantum chromodynamics (QCD) led theorists, in 1973, to predict the existence of the odderon formed by three gluons. Demonstrating its existence was a major experimental challenge, requiring detailed measurements of protons in high-energy collisions.

Already back in February 2018, the TOTEM experiment found evidence of the possible existence of this particle in the data on the elastic scattering of protons. The new work is based on an analysis of data from CERN and Fermilab based on measurements at different scattering angles. The TOTEM and DØ researchers compared the proton-proton data from the LHC with the proton-antiproton data from the Tevatron and found new evidence for the odderon with an independent method. The combination of the results of the two analyses (2018 and 2020) strengthened the initial evidence and upgraded it to the level of discovery.