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Precision Measurement of the Positive Muon Anomalous Magnetic Moment at 0.20 ppm

The muon anomalous magnetic moment, denoted as aμ=(g−2)/2, serves as a crucial low-energy observable, offering an exceptional avenue for precision measurement and computational evaluation. This parameter stands as a rigorous litmus test for the Standard Model (SM) of particle physics and provides a sensitive window into potential new physics beyond the SM framework. Recent concerted efforts have substantially advanced both theoretical predictions and experimental measurements of aμ. On the theoretical front, the Muon g−2 Theory Initiative, a global collaboration of over 100+ physicists, achieved a consensus in 2020 regarding the SM prediction for aμ. Simultaneously, on the experimental side, the E989 Muon g−2 Collaboration at Fermilab (FNAL) unveiled a groundbreaking measurement in April 2021, derived from the Run-1 dataset (2018), boasting an impressive precision of 0.46 ppm, and more recently a more precise result (0.2 ppm) came out which was based on 4-times more data (run-2,3) collected compared to run-1, this result aligns with previous findings from Brookhaven National Laboratory (BNL) as well as with our previous result from 2021. While accentuating the growing discrepancy with the SM prediction, reaching an intriguing 5.0 standard deviations. Here we delve into the experimental configuration and provide a comprehensive update on the ongoing status of the experiment.

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