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The Fermilab Muon g-2 Experiment

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The muon anomalous magnetic moment, $a_\mu = (g-2)/2$, is a low-energy observable that can be measured and calculated at a sub-ppm (part-per-million) precision, making it a stringent test of the Standard Model (SM) prediction and a probe for new physics. The Fermilab Muon g-2 experiment aims to measure a_μ with a precision of 140 ppb, marking a four-fold improvement in precision compared to its predecessor, the Brookhaven (BNL E821) experiment. In April 2021, our collaboration published the first results, based on the first year of data taking combined with BNL's data, a discrepancy between experimental measurement and the SM prediction (2020 Muon g-2 Theory Initiative) is established at $a_\mu(\text{Exp}) - a_\mu(\text{SM}) = (251 \pm 59) \times 10^{-11}$, with significance of 4.2σ. Later, in August 2023, inclusion of datasets collected during Run-2 and Run-3 had increased the significance to 5σ. The result based on complete dataset (inclusion of Run-4/5/6) is expected to be announced in 2025. If the central values of both measured and predicted values remain the same, it will lead to a tantalizing experiment-theory discrepancy of 8σ, which is definite evidence of beyond SM physics. In this talk, the overview of the Fermilab Muon g-2 experiment with a focus on the ω_a analysis, including improvements and upgrades made between the 2021 and 2023's results, will be discussed.

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