



Contribution ID: 24

Type: Invited Talk

Measurement of the fine-structure constant as test of the standard model

Wednesday, October 23, 2019 11:10 AM (30 minutes)

The fine-structure constant α is ubiquitous in physics, and a comparison among different experiments provides a powerful test of the Standard Model of particle physics. The most precise measurement of α (to date) is our recently published result, $\alpha^{-1} = 1/137.035999046(27)$, with an uncertainty of 200 parts per trillion (ppt). A $2.5 - \sigma$ tension with the value obtained from the electron gyromagnetic anomaly $g_e - 2$ is a potential sign of new physics that mirrors the well-known $3.7 - \sigma$ tension observed in the muon $g_\mu - 2$. It motivates a deeper investigation at the frontier of precision measurement. $g_\mu - 2$ is currently being re-measured by E989 at Fermilab, which expects to reduce the error more than threefold. Gerald Gabrielse (Northwestern University) is currently re-measuring $g_e - 2$ and expects an improvement by an order of magnitude to 20 ppt. We will present our result and our project to improve the accuracy in the fine-structure constant to 40 ppt and, eventually, 10 ppt.

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Session Classification: Session