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CANCELLED: Hadronic vacuum polarisation contribution to muon $g-2$ from lattice QCD

The anomalous magnetic moment of the muon, defined as the fractional difference of its gyromagnetic ratio from the naive value of 2, has been measured with an impressive accuracy of 0.54 parts per million in experiment (BNL E821), thus providing one of the most stringent tests of the Standard Model. Intriguingly, the experimentally measured anomaly disagrees by around 3 standard deviations with the calculated value from the Standard Model. The current theoretical uncertainty is dominated by that from the calculation of the lowest order “hadronic vacuum polarisation (HVP)”. Improvements in the experimental uncertainty by a factor of 4 in the upcoming experiment at Fermilab (E989) are expected and improvements in the theoretical determination would make the discrepancy (if it remains) really compelling in trying to ascertain the possibility of new physics beyond the Standard Model. I will report on the progress and plans for improving the theoretical calculation of the HVP contribution to the anomaly using our (HPQCD) lattice QCD method. We have achieved the most precise lattice results so far for this quantity on multiple lattices with physical up/down, strange and charm quarks in the sea. Our accuracy on the HVP is 2% and this is low enough for the first time to see (arXiv:1601.03071) a 3σ discrepancy between the Standard Model and experiment.

Summary

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Primary author: CHAKRABORTY, Bipasha

Presenter: CHAKRABORTY, Bipasha

Track Classification: Section G: Strongly Coupled Theories