

XVth Quark Confinement and the Hadron Spectrum



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Review of muon $g-2$: lattice, dispersive, and data driven results

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Almost twenty years ago, physicists at Brookhaven National Laboratory measured the magnetic moment of the muon with a remarkable precision of 0.54 parts per million. Since that time, the reference Standard Model prediction for this quantity has exhibited a persistent discrepancy with experiment of more than three sigma. This raises the tantalizing possibility of undiscovered forces or elementary particles.

The attention of the world was drawn to this discrepancy in 2021 when physicists at Fermilab presented the first results of a new experimental measurement, brilliantly confirming Brookhaven's measurement and bringing the discrepancy to a near discovery level of 4.2 sigma. This discrepancy was further enhanced to 5.1 sigma in 2023 with Fermilab's latest result, which reduces the measurement uncertainty by a factor of 2. However, in the meantime, new tensions have emerged between different determinations of the hadronic vacuum polarisation (HVP) contribution to the theoretical result.

In this plenary I will review the current status of theoretical determinations of the muon anomalous magnetic moment in the context of the latest experimental results. I will particularly focus on our evolving understanding of the HVP, and what this means for the possibility of new physics in this longstanding discrepancy.

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