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Dispersion relation for hadronic light-by-light scattering and the muon (g-2)

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The anomalous magnetic moment of the muon (g −2)μ has been measured and computed to very high precision of about 0.5 ppm. For more than a decade, a discrepancy has persisted between experiment and Standard Model prediction, now of about 3σ. The main uncertainty of the theory prediction is due to strong interaction effects. With the expected improvement of the input for hadronic vacuum polarisation, in a few years the subleading hadronic light-by-light (HLbL) contribution will dominate the theory error. While some constraints from QCD exist, the calculation of the HLbL contribution to the (g − 2)μ is plagued by a substantial model dependence. In this talk, I will present a dispersive approach to HLbL scattering, based on the fundamental principles of unitarity and analyticity [1] We have derived a Lorentz decomposition of the HLbL tensor that is fully gauge-invariant and crossing symmetric [2,3]. The scalar coefficient functions of this tensor decomposition are free of kinematic singularities and zeros and fulfil Mandelstam's double-dispersive representation. The dispersive formalism defines unambiguously and in a model-independent way both the pion-pole and the pion-loop contribution. Two-pion rescattering effects are included in a partial-wave picture. Our dispersive formalism shows a path towards a data-driven determination of the HLbL contribution to the (g − 2)μ [4].

References

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