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The pi^0/eta/eta' light-by-light contribution to the muon g-2 in Chiral Perturbation Theory with Resonances

The pion transition form factor, computed within Chiral Perturbation Theory with Resonances, is confronted to data. Good agreement is found including only the lightest multiplet of vector and pseudoscalar resonances. Short-distance constraints obtained by matching the Vector-Vector-Pseudoscalar resonance Green function to its QCD counterpart are satisfied with high accuracy. We evaluate the corresponding pion-exchange contribution to the hadronic light-by-light muon g-2 obtaining (6.66\pm0.21)\cdot10^{-10}.

Using the double-angle mixing scheme for the eta and eta' mesons, we employ the previous information to predict the corresponding transition form factors, that follow measurements well. Therefore, we also predict their contributions to the muon anomaly, which results in (10.47\pm0.54)\cdot10^{-10} for the sum of the pi^0/eta/eta' exchanges. This result is in accord with the reference determinations in the literature but reduces the error by roughly one third.

Besides this, we improve upon previous similar studies by:
i) including the whole complete set of consistent high-energy constraints.
ii) making a more robust error determination which includes, in particular, the effect of the uncertainty on the pion transition form factor value at the origin.
iii) updating the data used to include the most recent Belle measurements of the pion transition form factor.

We also propose to measure the cross-section and di-muon invariant mass distribution of the e^e^- -> mu^+mu^- P (P=pi^0-eta-eta') processes to improve the knowledge on these transition form factors.

The understanding of the current discrepancy (slightly above three sigmas for a decade) between the standard theory value and the measurement of the muon g-2 is one of the most striking anomalies in particle physics, specially in view of the lack of new Physics signals in direct searches at the LHC.

Summary

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