

Short Distance Constraints on the HLbL contribution to the muon $g - 2$

Daniel Melo-Porras, Edilson Reyes, Raffaele Fazio

The diagram illustrates the Feynman rules for calculating the HLbL contribution. On the left, a sum of 19 terms is shown, each involving a derivative of the tensor $T_i^{\mu_1\mu_2\mu_3\mu_4}$ evaluated at $q_4 \rightarrow 0$. The central part shows a loop diagram with a blue triangle and red wavy lines. Arrows indicate the flow of momentum. A downward arrow points to the result, which is a mathematical expression involving a sum over $l=0$ from infinity, a bracketed term, and a ratio of gamma functions. To the right, a complex plane plot shows a contour integral in the s -plane. The horizontal axis is $\text{Re}\{s\}$ and the vertical axis is $\text{Im}\{s\}$. The contour is a closed loop in the upper half-plane, with poles marked by dots along the real axis.

$$\sum_{i=0}^{19} \Pi_i \partial^{\mu_5} T_i^{\mu_1\mu_2\mu_3\mu_4} \Big|_{q_4 \rightarrow 0}$$
$$I^{(2)} \supset (\dots) \times \sum_{l=0}^{\infty} \left[-\frac{4m^2}{q^2} \right]^l \frac{\Gamma(-2+2\nu+l)}{\Gamma(-\nu-l+\frac{5}{2})} \frac{1}{\Gamma(l+1)\Gamma(l+\nu-1)} \ln \left\{ -\frac{q^2}{4m^2} \right\}$$