Figure 83: Summary of the current SM prediction for $a_\mu$ in comparison to experiment (red band and data points). The final WP25 prediction is denoted in black and via the blue band, it derives from the LO HVP result defined by the lattice-QCD "Avg. 1" shown in blue, see Eq. (3.37). The gray band indicates the WP20 result, based on the $e^+e^-$ experiments above the first dashed line. These experimental ranges, as well as the ones for SND20 and CMD-3 that appeared after WP20, are produced as in Fig. 27; they are meant to illustrate the current situation, but cannot be interpreted as uncertainties with a proper statistical meaning. The $\tau$ point refers to Eq. (2.23), the numerical results are collected in Table 5. In all cases except for the gray WP20 band the LO HVP results are combined with WP25 values for the remaining contributions, as summarized in Table 1. The figure has been updated after the announcement of the final results from the Fermilab experiment, including the corrections to the previous experimental points as detailed in Ref. [8].

obtain

$$a_\mu^{\text{HLbL}} = 112.6(9.6) \times 10^{-11} \qquad \text{(phenomenology + lattice)} , \tag{9.2}$$

where the uncertainty includes a scale factor $S = 1.5$. With this average, the NLO contribution in Eq. (5.70) slightly changes to $a_\mu^{\text{HLbL, NLO}}(\text{phenomenology + lattice}) = 2.8(6) \times 10^{-11}$, and the total HLbL contribution becomes

$$a_\mu^{\text{HLbL}} + a_\mu^{\text{HLbL, NLO}} = 115.5(9.9) \times 10^{-11} \qquad \text{(phenomenology + lattice)} . \tag{9.3}$$

Combining Eqs. (9.1) and (9.3) with the QED and EW contributions from Eqs. (7.27) and (8.12), we obtain for the final SM prediction

$$a_\mu^{\text{SM}} = 116\,592\,033(62) \times 10^{-11} , \tag{9.4}$$

which can be compared to the current experimental average [5–8, 10–13][48]

$$a_\mu^{\text{exp}} = 116\,592\,071.5(14.5) \times 10^{-11} . \tag{9.5}$$

At the current level of precision there is no tension between the SM prediction and the experimental world average:

$$\Delta a_\mu \equiv a_\mu^{\text{exp}} - a_\mu^{\text{SM}} = 38(63) \times 10^{-11} . \tag{9.6}$$

This marks a significant shift from the conclusions of WP20, which is driven by the developments relating to the HVP LO contribution, as can be seen in Table 33 and Fig. 83.

---

[48]This paper was posted on arXiv on May 28, 2025. Sections 2 to 8 and all numbers pertaining to the SM prediction have remained unchanged, but the experimental world average has been updated according to the E989 announcement on June 3, 2025 [8], and the description in Secs. 0, 1, and 9 has been adapted accordingly. In particular, the experimental results in abstract, Table 1, Figs. 27, 40, and 83, and Sec. 9 have been updated.