The Muon g-2 Experiment: Review the Controversy
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The ability to measure the leptonic anomalous magnetic moment very
precisely provides a stringent test on the Standard Model (SM). The
current experimental result of the measurement of the anomalous mag-
netic moment of muon $a_{\mu}$ (up to relative precision of 0.5 ppm) from the
BNL Muon g-2 experiment (E821) shows a discrepancy of $2.4\sigma$ between
the experimental result and the theoretical value predicted by the SM.
Some has argued that this might hint a ‘New Physics’ beyond the SM.
However, in the calculation of the $a_{\mu}$ from the SM, though the QED and
the electroweak contributions can be determined up to sufficient preci-
sion to compare with the experimental result, the hadronic contribution
depends upon the experimental data from either the $e^+e^-$ annihilation
to hadrons or the hadronic $\tau$ decay. By using the latter dataset, the
discrepancy between experimental determination of $a_{\mu}$ and the SM is re-
duced to $0.9\sigma$. The controversy lies in the fact that the experimental
results from the $e^+e^-$ annihilation to hadrons or the hadronic $\tau$ decay
are inconsistent with each other by themselves. Further investigations
are needed before a conclusion can be made.

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