

Frontiers of Lattice Gauge Theory: muon $g-2$ and lattice chiral gauge theories

In this talk I give an overview of recent progress on two topics within the domain of lattice gauge theory.

The first part highlights the role of Lattice QCD in obtaining a Standard Model (SM) value for the anomalous magnetic moment of the muon, which has now been measured with a precision of better than 0.2 ppm. Hadronic corrections dominate the error on the SM prediction, and were traditionally obtained dispersively from hadronic electroproduction data, showing a potentially significant discrepancy between experiment and the Standard Model. Recently, Lattice QCD has taken the lead in narrowing down the SM value, which is now known to about 0.4 ppm, and, unexpectedly, in excellent agreement with the experimental value. This error will be further reduced in the future.

Switching gears, the second part surveys the long-standing problem of formulating chiral gauge theories on the lattice. As the lattice provides the only method to define quantum field theories nonperturbatively, this is an important theoretical problem, as both the Standard Model and many Beyond-the-Standard-Model theories are chiral gauge theories. Despite 40+ years of very creative ideas, this is still an open problem!

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