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Problems in the Standard Model: from neutrino mass to dark matter

We discuss the main problems and theoretical difficulties in the Standard Model, that impact fundamental physics, the search for new physics and challenge future experimental progress in precision exotic physics, observational cosmology and particle physics. Despite its great predictive power and major successes, the model fails answering several questions and incorporate gravity in a consistent theory. We analyze a number of unsolved issues in the Standard Model, such as the vacuum instability problem, gauge coupling unification, neutrino mass, strong CP problem, hierarchy problem, flavor problem, dark matter, baryon asymmetry, quantum triviality and Landau pole problem, L and B number violations, and cosmological constant problem as well as their implications on cosmological inflation and the quantum nature of gravity. We emphasize the limitations of the model, with a specific focus on theoretical predictions that go beyond the Standard Model and potential direct tests of fundamental symmetries and their couplings to gravity.

Mini-abstract

We discuss the main open problems and theoretical inconsistencies in the Standard Model.

Experiment/Collaboration

QMAPP, MQCQE, Macquarie University

Primary author: Dr ERIC, Howard (Macquarie University, CSIRO, Griffith University)

Presenter: Dr ERIC, Howard (Macquarie University, CSIRO, Griffith University)

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