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Beyond Form Factors: Precise Angular Tests in Hadronic τ Decays

Semileptonic τ decays mainly proceed via interactions between charged lepton and quark currents. The hadronization of the quark current is intrinsically nonperturbative and generally cannot be addressed analytically. In this work, we propose using symmetry arguments alone to construct clean angular observables, which, within the Standard Model and in the absence of long-distance electromagnetic corrections, remain form-factor independent. These predictions can be experimentally tested, and any observed deviation could signal either effects of physics beyond the Standard Model or provide a clean benchmark for long-distance electromagnetic corrections. We also explore a first estimate of the expected impact from both sources on these observables.

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