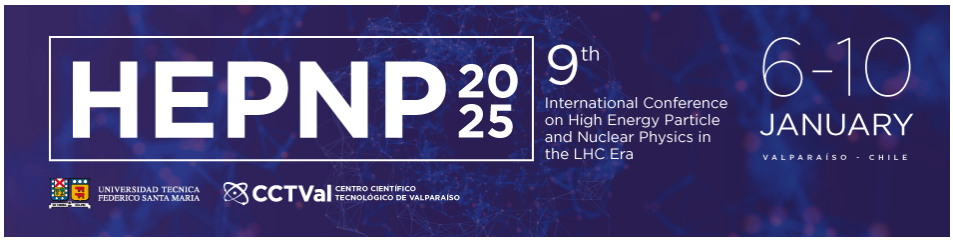

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QCD Running in Lepton Number Violating Meson and Tau Decays

Thursday 9 January 2025 17:10 (20 minutes)

Below the electroweak scale, new physics that violates lepton number in two units ($\Delta L = 2$) and is mediated by heavy particle exchange can be parameterized by a dimension-9 low-energy effective Lagrangian.
Operators in this Lagrangian involving first-generation quarks and leptons contribute to the short-range mechanism of neutrinoless double beta decay ($0\nu\beta\beta$) and therefore they are strongly constrained.
On the other hand, operators with other quark and lepton families are bounded by the non-observation of different lepton number violating (LNV) meson and tau decays, such as $M_1^- \to M_2^+ \ell_1^- \ell_2^-$ and $\tau^- \to \ell^+ M_1^- M_2^-$.
In this work, we calculate RGE-improved bounds on the Wilson coefficients involved in these decays.
We calculate QCD corrections to the dimension-9 operator basis and find RG evolution matrices that describe the evolution of the Wilson coefficients across different energy scales. Unlike the running of operators involved in $0\nu\beta\beta$-decay, the general flavor structure leads to the mixing of not only different Lorentz structures but also of different quark-flavor configurations. Additionally, operators that vanish for the identical lepton case need to be added to the operator basis.
We find new constraints on previously unbounded operators and the enhancement of bounds for specific Wilson coefficients.
We also find new bounds coming from the mixing between operators with different quark-flavor configurations.

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