

Whispers from the Dark Universe - Particles & Fields in the Gravitational Wave Era

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WHISPERS FROM THE DARK UNIVERSE – PARTICLES & FIELDS IN THE GRAVITATIONAL WAVE ERA

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Searching for LNV in rare meson decays

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We investigate the possibility of disentangling different new physics contributions to the rare meson decays $K \rightarrow \pi + \text{invisible}$ and $B \rightarrow K(K^*) + \text{invisible}$ through kinematic distributions in the missing invariant mass squared. We employ dimension-6 operators within the Low-Energy Effective Field Theory (LEFT), identifying the invisible part of the final state as either active or sterile neutrinos. Special emphasis is given to lepton-number violating (LNV) operators. We show analytically that contributions from vector, scalar, and tensor quark currents can be uniquely determined from experimental data of kinematic distributions. As there could *a priori* also be new invisible particles in the final states, we include dark-sector operators giving rise to two dark scalars, fermions, or vectors in the final state. We show that careful measurements of kinematic distributions make it theoretically possible to disentangle the contribution from LEFT operators from most of the dark-sector operators, even when multiple operators are contributing. Finally, we point out that an excess in rare meson decays consistent with a LNV hypothesis would point towards highly flavor non-democratic physics in the UV, and could put high-scale leptogenesis under tension.

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