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A Model of Low-Scale Pati-Salam Gauge Bosons

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We propose an E_6 -inspired Pati-Salam (PS) model that naturally accommodates multi-TeV leptoquark gauge bosons, X_{μ} , while incorporating an unbroken discrete Z_2 symmetry. In this model, Standard Model (SM) fermions are Z_2 -even, while exotic fermions in the PS multiplets are Z_2 -odd. A notable feature is that the PS gauge bosons are Z_2 -odd, resulting in their coupling exclusively between ordinary and exotic fermions. This prevents flavor-violating meson decays at the tree level, with such effects arising only at the one-loop level, allowing for a lower PS breaking scale. The most stringent constraint arises from meson decays, particularly $K_L \rightarrow \mu e$, allowing PS gauge boson masses as low as m_X

 $gtrsim\mathcal{O}(\text{few})$ TeV. This relatively low PS scale offers exciting collider prospects for probing leptoquark gauge bosons as well as vector-like fermions. Additionally, we explore compelling mechanisms for generating small neutrino masses via either a tree-level seesaw or one-loop scotogenic realization. The unbroken Z_2 symmetry also allows for a dark matter (DM) candidate, which could be either a singlet-doublet fermionic DM or a singlet scalar DM.

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