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Third-Family Lepton-Quark Fusion

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We analyze the signatures of new physics scenarios featuring third-family quark-lepton unification at the TeV scale in lepton-quark fusion at hadron colliders. Working with complete UV dynamics based on the $SU(4)$ gauge symmetry in the third-family fermions, we simulate the resonant production of a vector leptoquark at the next-to-leading order, including its decay and matching to the parton showers. The precise theoretical control over this production channel allows us to set robust bounds on the vector leptoquark parameter space which are complementary to the other production channels at colliders. We emphasize the importance of the resonant channel in future searches and discuss the impact of variations in the model space depending on the flavor structure of the vector leptoquark couplings.

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