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Kinematic Discriminants of Double Parton Scattering in Vector Boson Final States at LHC

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Double parton scattering (DPS) processes provide a way to study the multi-parton interactions and spatial and momentum correlations within the hadrons. While traditional DPS studies use simple models like the "pocket formula", recent QCD-based approaches with parton splittings and correlations offer a more dynamic view. This study analyzes DPS at the LHC, focusing on same-sign WW, WZ, and ZZ final states by combining theoretical predictions and Monte Carlo simulations. Using DPS simulation with double parton distributions (dPDFs) and angular-ordered parton evolution, we explore various observables such as inter-lepton azimuthal separation, transverse momentum imbalance, and rapidity gaps across different kinematic regimes, comparing them with results from traditional Monte Carlo generators like PYTHIA and HERWIG. We also assess the importance of quark flavor decomposition and parton flavor correlations, which are not well-constrained in current LHC data. This study seeks to identify unique DPS signatures beyond cross-section measurements which could be useful for future experimental analyses to better understand multi-parton interactions at the LHC.

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