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Tau Polarization as a Discriminator for BSM Particles in Ditau Final States

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Motivated by potential excesses observed in third-generation fermion channels at the LHC, many proposed SM extensions predict new particles that couple preferentially to tau leptons, such as leptoquarks, Z' bosons, and Type-II two-Higgs-doublet models. These scenarios can be distinguished through tau polarization, a crucial observable for separating scalar from vector particles in ditau final states.

This phenomenological work improves upon traditional maximum-likelihood techniques by employing machine learning algorithms. By developing a robust polarization estimator, this approach separates competing particle hypotheses, thereby enhancing the sensitivity of searches for physics beyond the Standard Model.

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