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Inclusive Drell-Yan Production with Leptoquarks: Simulating NLO effects in non-resonant Dilepton Searches

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Motivated by the long-standing hints of lepton-flavour non-universality in the $b \longrightarrow c\ell\nu$ and $b \longrightarrow s\ell^+\ell^-$ channels, we study Drell-Yan production at the Large Hadron Collider (LHC) in the context of leptoquarks (LQs). Based on the latest LHC dilepton analyses

corresponding to an integrated luminosity of around $140 \,\mathrm{fb}^{-1}$ of proton-proton collisions at $\sqrt{s} = 13 \,\mathrm{TeV}$, we present improved limits on the scalar LQ couplings that involve heavy quark flavours and light or heavy dileptons. Moreover, we provide the full $\mathcal{O}(\alpha_s)$ corrections to the $pp \longrightarrow \tau^+ \tau^-$ process in the presence of gauge vector LQs. In particular, we show that effects beyond the leading order that are related to real QCD emissions are relevant since the inclusion of additional heavy-flavoured jets notably improves the exclusion limits that derive from the high-mass dilepton tails. Within the POWHEG-BOX framework we present a dedicated Monte Carlo code that allows for an on-the-fly signal event generation including all relevant LQ corrections.

Summary

Primary author: Mr SCHULTE, Stefan (Max Planck Institute for Physics (MPP))

Co-authors: Mr SCHNELL, Luc (Max Planck Institute for Physics (MPP)); Dr HAISCH, Ulrich (Max Planck Institute for Physics (MPP))

Presenter: Mr SCHULTE, Stefan (Max Planck Institute for Physics (MPP))

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