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The LHC as Lepton–Proton Collider: Search for the Resonant Production of Leptoquarks

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Searches for leptoquarks are a key component of the LHC program probing physics beyond the Standard Model. These hypothetical particles couple to a lepton and a quark and are predicted by many extensions of the Standard Model such as Grand Unified Theories. The existing leptoquark searches at the LHC currently mostly consider production modes via quark and/or gluon interactions. However, the small but non-zero lepton content of the proton allows to also study the significantly less explored s-channel, resonant leptoquark production. This production mode gives rise to lepton-plus-jet signatures. Thus, leptoquarks would emerge as distinctive peaks over the smoothly falling Standard Model background in the invariant mass spectrum of the lepton-plus-jet system. The poster will give an overview of the first ATLAS analysis searching for this new process in four separate final states involving light leptons plus either jets originating from light quarks or from bottom quarks. It will especially focus on the details of the search for the electron-plus-jet signature. The general analysis strategy and the results of this search will be discussed. Probing the resonant, s-channel production shows competitive and complementary sensitivity to existing searches for e.g. the pair production of leptoquarks, particularly for leptoquarks with a high coupling to fermions. To maximize the sensitivity reach, the full ATLAS Run2 dataset is combined with the partial Run3 dataset of 2022 and 2023 for this search.

Secondary track

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