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Improved constraints on the heavy gauge bosons decaying into a vector boson and a Higgs boson at the LHC

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The search for physics beyond the Standard Model (SM) is a major focus of the physics program at the Large Hadron Collider (LHC). Since its discovery, the Higgs boson has become a tool in this search. In particular, one may expect new heavy resonances to couple to Higgs bosons and weak vector bosons ($V = W$ or Z). Such resonances are expected to occur in a number of theories beyond the Standard Model. Theories that aim to solve the naturalness problem predict the existence of vector resonances as expected in composite Higgs models [1], Little Higgs models,or models with extra dimensions.The extended gauge models are among the best motivated theoretical scenarios beyond the SM that predict the existence of new heavy neutral and charged vector bosons (Z' and W') with their diboson decay modes, $V' \to VV/VH$, caused by $Z - Z'$ and $W - W'$ mixing [2-4]. These models are considered as benchmark scenarios for diboson resonances having spin-1 ($W' \to WZ$ or WH, $Z' \to WW$ or ZH), produced predominantly via quark-antiquark annihilation ($q\bar{q}' \to W'$, $q\bar{q} \to Z'$).
The full CMS and ATLAS Run 2 datasets with time-integrated luminosity of 137 fb^{-1} and 139 fb^{-1} in the diboson channels are used to probe benchmark models with extended gauge sectors such as left-right symmetric (LR) and the sequential standard model (extended gauge model, EGM), that predict the existence of neutral Z′ - and charged W′ - bosons decaying to a pair of bosons ZH and WH in the semileptonic final state. These benchmark models are used to interpret the results. Exclusion limits at the 95\% C.L. on the Z' and W' resonance production cross section times branching ratio to electroweak gauge boson pairs in the resonance mass range between 1.0 and 5 TeV are here converted to constraints on Z-Z′ and W-W′ mixing parameters and masses. We present exclusion regions on the parameter spaces of the Z' and W' and show that the obtained exclusion regions are significantly extended compared to thosederived from the previous analysis performed with Tevatron data as well as with the CMS and ATLAS data collected at 7 and 8 TeV in Run1 [5]. The reported limits are the most restrictive to date.

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