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(G*) Search for heavy resonances decaying into a pair of Z bosons with the ATLAS detector

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Since the discovery of the Higgs boson with a mass of about 125 GeV in 2012 by the ATLAS and CMS Collaborations, an important remaining question is whether this particle is part of an extended scalar sector as postulated by various extensions to the Standard Model. Many of these extensions predict additional Higgs bosons, motivating searches in an extended mass range. Here we report on a search for new heavy neutral Higgs bosons decaying into a pair of Z bosons in the $\ell^+\ell^-\ell^+\ell^-$ and $\ell^+\ell^-\nu\bar{\nu}$ final states, where ℓ stands for either an electron or a muon. The search uses proton-proton collision data at a centre-of-mass energy of 13 TeV collected from 2015 to 2018 by the ATLAS detector during Run 2 of the Large Hadron Collider, corresponding to an integrated luminosity of 139 fb^{-1} . Different mass ranges spanning from 200 GeV to 2000 GeV for the hypothetical resonances are considered, depending on the final state and model. In the absence of a significant observed excess, the results are interpreted as upper limits on the production cross section of a spin-0 or spin-2 resonance. The upper limits for the spin-0 resonance are translated to exclusion contours in the context of Type-I and Type-II two-Higgs-doublet models, and the limits for the spin-2 resonance are used to constrain the Randall-Sundrum model with an extra dimension giving rise to spin-2 graviton excitations.

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