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Search for new resonances decaying to pairs of highly merged diphotons in proton-proton collisions at 13 TeV with the CMS detector

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A search for a massive resonance X decaying to a pair of spin-0 bosons ϕ that themselves decay to pairs of photons (γ), is presented. The search is based on CERN LHC proton-proton collision data at $\sqrt{s} = 13$ TeV, collected with the CMS detector, corresponding to an integrated luminosity of 138 fb^{-1}. The analysis considers masses m_X between 0.3 and 3 TeV, and is restricted to values of m_ϕ for which the ratio m_ϕ/m_X is between 0.5 and 2.5\%. In these ranges, the two photons from each ϕ boson are expected to spatially overlap significantly in the detector. Two neural networks are created, based on computer vision techniques, to first classify events containing such merged diphotons and then to reconstruct the mass of the diphoton object. The mass spectra are analyzed for the presence of new resonances, and are found to be consistent with standard model expectations. Model-specific limits are set at 95\% confidence level on the production cross section for $X \to \phi\phi \to (\gamma\gamma)(\gamma\gamma)$ as a function of the resonances'masses, where both the $X \to \phi\phi$ and $\phi \to \gamma\gamma$ branching fractions are assumed to be 100\%. Observed (expected) limits range from 0.03 - 1.06 fb (0.03 - 0.79 fb) for the masses considered, representing the most sensitive search of its kind at the LHC.

Mini Symposia (Invited Talks Only)

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