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Gravitational Imprints from Heavy Kaluza-Klein Resonances

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We study the holographic phase transition of the radion field in a five-dimensional warped model which includes a scalar potential with a power-like behavior. We consider Kaluza-Klein (KK) resonances with masses $m_{\rm KK}$ at the TeV scale or beyond. The backreaction of the radion field on the gravitational metric is taken into account by using the superpotential formalism. The confinement/deconfinement first order phase transition leads to a gravitational wave stochastic background. Its power spectrum peaks at a frequency that depends on the amount of tuning required in the electroweak sector. We find that the present and forthcoming gravitational wave observatories can probe scenarios where the KK resonances are very heavy. Current aLIGO data already rule out vector boson KK resonances with masses in the interval $m_{\rm KK} \sim (1-10)\times 10^5$ TeV. Future gravitational experiments will be sensitive to resonances with masses $m_{\rm KK}$ 10^5 TeV (LISA), 10^8 TeV (aLIGO Design) and 10^9 TeV (ET). Finally, we also find that the Big Bang Nucleosynthesis bound in the frequency spectrum turns into a lower bound for the nucleation temperature as $T_n > 10^{-4}\sqrt{N}\, m_{\rm KK}$. This work is based on Ref.[1]. Other related references are [2-4].

[1] E. Megias, G. Nardini, M. Quiros, 2005.XXXX [hep-ph].
[2] L. Randall and G. Servant, JHEP 05, 054 (2007), arXiv:hep-ph/0607158 [hep-ph].
[3] T. Konstandin, G. Nardini, and M. Quiros, Phys. Rev. D82, 083513 (2010), arXiv:1007.1468 [hep-ph].
[4] E. Megias, G. Nardini, and M. Quiros, JHEP 09, 095 (2018), arXiv:1806.04877 [hep-ph].

Is this abstract from experiment?

No

Is the speaker for that presentation defined?

Yes

Name of experiment and experimental site

N/A

Internet talk

Yes

Details

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