



Contribution ID: 40

Type: **not specified**

Gravitational waves from current-carrying domain walls

Wednesday 28 May 2025 14:20 (20 minutes)

Domain wall (DW) networks may have formed in the early universe following the spontaneous breaking of a discrete symmetry. Notably, several particle physics models predict the existence of current-carrying DWs, which can capture and store particles as zero modes on it. In this study, we demonstrate that gravitational waves (GWs) generated by current-carrying DWs with fermionic zero modes exhibit a novel feature: an additional peak with a distinct spectral shape in the GW spectrum resembling mountains, arising from metastable topological remnants, which we term “spherons.” This distinct signature could be detectable in upcoming GW observatories such as LISA. The results suggest that DW networks in beyond Standard Model scenarios could emit GW signals that are significantly stronger and with greater detectability than previously expected.

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Session Classification: Gravitational Waves