Contribution ID: **552** Type: **Talk in the parallel session**

Radiation from Global Cosmic Strings using Adaptive Mesh Refinement

Monday, 5 July 2021 18:40 (20 minutes)

We present results from adaptive mesh refinement (AMR) simulations of global cosmic strings. Using the public code, GRChombo, we perform a quantitative investigation of the dynamics of single sinusoidally displaced string configurations. We study a wide range of string energy densities $\mu \propto \ln \lambda$, defined by the string width parameter λ over two orders of magnitude. We investigate the resulting massless (Goldstone boson or axion) and massive (Higgs) radiation signals, using quantitative diagnostic tools to determine the eigenmode decomposition. Given analytic radiation predictions for global Nambu-Goto strings, we compare the oscillating string decay with a backreaction model accounting for radiation energy losses, finding excellent agreement. We establish that backreaction decay is accurately characterised by the inverse square of the amplitude being proportional to the inverse tension μ for $3 \leq \lambda \leq 100$. The investigation of massive radiation at small to intermediate amplitudes finds evidence that it is suppressed exponentially relative to the preferred massless channel with a $\sqrt{\lambda}$ dependence in the exponent. We conclude that analytic radiation modelling in the thin-string (Nambu-Goto) limit provides the appropriate cosmological limit for global strings.

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Session Classification: From Cosmic Strings to Superstrings

Track Classification: Cosmic Strings: From cosmic strings to superstrings