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Silk damping in induced gravitational waves: a novel probe for new physics

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The early universe is a natural laboratory for high-energy physics, and gravitational waves, as direct probes of this epoch, inherently carry rich information related to high-energy physics. Silk damping, resulting from dissipation in the cosmic fluid, is a significant physical phenomenon in the early universe. In this talk, I will introduce our first study on Silk damping in induced gravitational waves. Silk damping notably suppresses the spectrum of induced gravitational waves on scales comparable to a diffusion scale at the decoupling of weakly-interacting particles. This characteristic suppression offers a novel and general observable for detecting the underlying particle interaction, especially for those mediated by heavy gauge bosons beyond the Standard Model. We anticipate that pulsar timing arrays are sensitive to gauge bosons with masses ~ 10^3–10^4 GeV, while space- and ground-based interferometers to those with masses ~ 10^7–10^{12} GeV, leading to essential complements to traditional high-energy physics experiments.

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