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Probing the Early and Late Universe with the Gravitational-Wave Background

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One of the most exciting targets for current and future gravitational-wave (GW) observatories is the stochastic GW background (SGWB)—a persistent all-sky signal, sourced by the incoherent emission of GWs from many independent sources throughout the history of the Universe. In particular, the SGWB is a sensitive probe of cosmic strings: line-like topological defects formed through spontaneous symmetry breaking at extreme energy scales in the early Universe. Searches for cosmic strings therefore allow us to probe particle physics at scales far beyond the reach of collider experiments. I will discuss the GW signals associated with cosmic strings, and their detection prospects with LIGO/Virgo and LISA.
Another important SGWB signal at much lower redshift is the astrophysical GW background (AGWB), generated by the superposition of many compact binary coalescences. These act as tracers of the galaxy distribution, and therefore offer a novel probe of large-scale structure. I will describe the calculation of the AGWB angular power spectrum using large N-body simulations, and discuss the implications of these observables for late-Universe cosmology.

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