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Probing the maximum temperature ever reached in the universe with ET

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There are a few examples where the accuracy of theoretical predictions is running ahead of that of experiments. One is the case of gravitational waves naturally sourced by hydrodynamical fluctuations in a thermal medium. These signals are motivated by the Standard Model of particle physics, predicting that, for the first three hundred thousand years, the fundamental constituents of the matter filling our universe were in equilibrium with each other, constituting a thermal plasma. This picture is confirmed by the fact that we observe a perfect black-body electromagnetic background radiation in each direction of the sky, the CMB. Since the corresponding gravitational wave spectrum is expected to show rapid growth at high frequencies, ET may offer unprecedented prospects to detect these signals. Nevertheless, while the spectral shape is well understood, the maximal amplitude is set by the plasma temperature at emission. To set an upper bound on the gravitational wave production, we have evaluated the maximal temperature reached in different early universe scenarios.

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