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Relic gravitons, single gravitons and high-frequency detectors

Tuesday, March 19, 2024 3:00 PM (1 hour)

The gravitons produced during the early stages of the evolution of the space-time curvature represent an ideal triple point where theoretical physics, high-energy physics and cosmology meet for different purposes. After a general introduction, I will focus on some recent results and argue that relic gravitons will represent, in the years to come, the sole direct probe of the the post-inflationary expansion history prior to big-bang nucleosynthesis. Along this perspective I will swiftly discuss the pulsar timing arrays and the audio band where wide-band detectors are currently operating. I will then suggest that the high-frequency gravitons in the MHz and GHz regions can be detected by using microwave cavities and electromechanical detectors as firstly propounded over thirty years ago. The sensitivities in the chirp amplitude should however improve by, at least, 10 or 15 orders of magnitude in comparison with the ones currently achievable in the audio band (i.e. between few Hz and few kHz). I will then analyze the high-frequency detectors in the framework of Hanbury-Brown Twiss interferometry and argue that they are actually more essential than the ones operating at lower frequencies if we want to investigate the quantumness of the relic gravitons and their associated second-order correlations. In particular the statistical properties of thermal and non-thermal gravitons can be distinguished by studying the corresponding Bose-Einstein interference effects.

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