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The Quest for the Gravitational-Wave Stochastic Background

According to various cosmological scenarios, we are bathed in a stochastic background of gravitational waves generated in the first instants after the Big Bang. This background is based on the amplification of vacuum fluctuations during inflation, as well as on additional GW radiation produced in the final stages of inflation (for example in preheating models or models of axion inflation). Detection of this background would have a profound impact on our understanding of the evolution of the Universe, as it represents a unique window on the physical laws that apply at the highest energy scales, potentially up to the Grand Unified Theory (GUT) scale 10^16 GeV. Other models of cosmological GW background include phase transitions, cosmic (super)string models, and pre Big Bang models.

In addition to the cosmological background, an astrophysical background may have resulted from the superposition of a large number of unresolved sources since the beginning of stellar activity. This astrophysical contribution could be a foreground masking the cosmological background, but it can also provide very interesting informations, not only about the physical properties of the respective astrophysical populations, complementing individual GW detections, but also about the evolution of these objects with redshift, the star formation history or the metallicity.

In this talk, I will give an overview of the different sources and present the data analysis methods used in the LIGO/Virgo collaboration to measure the energy density of the GW background. I will also discuss how the future generation of detectors can be used to remove the astrophysical foreground in both earth and space detectors.

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