



Contribution ID: 45

Type: poster

Gamma-ray bursts and gravitational waves joint analysis with the LIGO-Virgo network

Wednesday, 20 February 2019 18:20 (1 minute)

In the context of the unmodelled search for gravitational waves associated to *gamma-ray bursts* (GRB), we present a sensitivity study conducted using *X-Pipeline*, a software which combines the data from LIGO and Virgo in correlation with the GRB direction in the sky. The goal is to understand how the addition of Virgo to the network of interferometers impacts the sensitivity of the search. The overall sensitivity, limited by non-stationary noise, is estimated through the efficiency in recovering simulated gravitational waves signals injected in the data, and then it is compared to the sensitivity obtained without including Virgo. For 4 out of 9 GRBs detected in August 2017, adding Virgo results in lower upper limits on the amplitudes of the injected waveforms in the [20, 500] Hz band, improving the sensitivity up to a factor of ~60%. For the 5 GRBs left, the addition of Virgo reduced the sensitivity up to ~25%. We find that the crucial factor is the ratio between the detector angular response and its noise power spectrum: when this quantity computed for Virgo is smaller than for LIGO, the Virgo inclusion results in a better sensitivity. This gives us a metric for the Virgo inclusion in this search for the next observing run.

Summary

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Session Classification: Poster session

Track Classification: Gravitational Waves