Contribution ID: **4** Type: **not specified**

Glitch mitigation using the null stream: A science case for the triangular design of the Einstein Telescope

Friday, 8 November 2024 13:50 (20 minutes)

Gravitational wave observatories frequently encounter noise transients, called glitches, that overlap with the signal. The glitches need to be carefully reconstructed and subtracted before analysing the signal. When the glitches do not overlap with the signal, the data surrounding it is simply discarded. For the proposed third-generation interferometers, such as the Einstein Telescope, most glitches will overlap with the signal as every stretch of data is expected to contain a signal. Therefore, a robust glitch mitigation algorithm will be crucial to optimize the potential of third-generation interferometers. In this work, we present a novel algorithm to this end. Our method leverages the null stream of the Einstein Telescope, a unique feature of its proposed triangular geometry. We demonstrate that we can reconstruct and subtract glitches arbitrarily close to the signal without contaminating the signal. Our method is easily adaptable to unknown signal and glitch morphologies and when multiple signals and glitches are overlapping.

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Session Classification: Parallel Sessions (II)