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Gravity-Gradient Noise Mitigation via Deep Learning for the Einstein Telescope

As the first gravitational wave observatory of the third generation, the future Einstein Telescope (ET) aims to improve current sensitivities by at least one order of magnitude over the whole detection band. Specifically, in the low-frequency band below 10 Hz, gravity-gradient noise caused by seismic perturbations is anticipated to be the limiting noise contribution. Therefore, the underground construction and additional mitigation will be critical for ET to achieve design sensitivity. The associated challenge is a precise reconstruction of gravity-gradient noise based on the activity recorded by an array of auxiliary seismic sensors. On the poster, we present a first proof-of-concept for a model-independent approach based on a stochastic seismic simulation and analytical gravity-gradient noise model. In addition, cancellation performance and sensor noise robustness tests for a spatiotemporal ResNet architecture are discussed, along with the potential for sensor array optimization.

Collaboration / Activity

Einstein Telescope

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