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Towards a more realistic Seismometer Position Optimization for Newtonian Noise Mitigation

At the Einstein Telescope, Newtonian noise is expected to be the dominant noise for low frequencies. Its impact is proposed to be reduced with the help of an array of seismometers that will be placed around the interferometer endpoints. As boreholes for seismometers are expensive, their positions should be optimized. Up to now, this was done based on an analytical calculation that makes simplifying assumptions.

We have developed a three-dimensional simulation of seismic body waves and their gravitational effect on an array of test masses. It also simulates the displacement measured by arbitrarily placed seismometers. With this flexible simulation, some of the limitations of the analytical calculations can be lifted. Furthermore, it enables the training of machine-learning-based mitigation techniques. First results using convolutional and graph neural networks will be shown in the presentation. This simulation provides an important link between the analytical description and complex seismic models that are currently being developed.

Authors: KELLETER, Jan (RWTH Aachen University); ERDMANN, Johannes (RWTH Aachen University); BACH-LECHNER, Markus (RWTH Aachen University); SCHILLINGS, Patrick (RWTH Aachen University)

Presenter: SCHILLINGS, Patrick (RWTH Aachen University)

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