Cancellation of gravity noise in underground detectors

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Terrestrial gravity noise, also known as Newtonian noise (NN), will be a significant low-frequency noise contribution in present and future-wave detectors. Lowering this kind of noise is important since it will allow us to explore the existence of intermediate black holes and improve estimation of source parameters.

Current research focuses on NN from seismic fields. So far, only the cancellation of NN from seismic surface waves (Rayleigh waves) has been studied. However, also seismic body waves can give rise to Newtonian noise in surface detectors, but also (and especially) in underground detectors, where the test mass will be surrounded by rock. Building detectors underground, as planned for the Einstein Telescope, has the purpose to mitigate NN, but this will not be enough for ambitious low-frequency sensitivity targets as set by the Einstein Telescope. Additional mitigation can be achieved with coherent noise cancellation.

In this talk, results will be presented concerning the optimization of seismometer arrays for cancellation of NN from seismic body waves with Wiener filters. Optimal array configurations are shown together with the corresponding cancellation performance. The results make us confident that NN cancellation is a possible technology to help achieving the sensitivity target of the Einstein Telescope.