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Potential of Seismic and Newtonian Noise Suppression in ET using distributed fiber sensors

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Newtonian noise significantly impacts the Einstein Telescope's low-frequency performance. To address this, one approach is to use large sensor arrays to capture the seismic field, estimate test mass acceleration, and subsequently adjust the gravitational wave data during post-processing. Fiber sensors are becoming a practical technology to the challenges of large seismic sensor networks because they can sense seismic movements all along their length.

Our research, conducted at the science campus in Hamburg Bahrenfeld in collaboration with the WAVE initiative, explores the capabilities and limitations of current distributed acoustic sensing (DAS) technology using fiber sensors. This includes assessing how these systems can be effectively employed for seismic and Newtonian noise suppression in ET. In this presentation, we will share the latest findings from the WAVE network, mainly focusing on the low-frequency performance of DAS systems and the potential enhancements achievable through fiber sensors that are read out using digitally-enhanced interferometry.
Additionally, we will show the status and results from our simulations on reducing Newtonian noise using distributed strainmeters. We'll look at how a network of strainmeters, explicitly designed around ET's test masses, performs in comparison to a seismometer network.

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