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Environmental Noise Monitoring with Distributed Acoustic Sensing: Insights from the WAVE Seismic Network

Distributed Acoustic Sensing (DAS) turns standard telecommunication fibers into dense seismic arrays with thousands of measurement points. Within the WAVE initiative, a 16 km fiber provides more than 16,000 virtual seismic channels in collaboration with DESY on the Bahrenfeld research campus in Hamburg. The project investigates how such large-scale DAS networks can advance environmental monitoring, geophysics, and the operation of large research facilities, especially gravitational wave detectors.

We report on the current status of the WAVE seismic network, ongoing plans to extend fiber installations into experimental halls that contain a high-precision gravitational-wave experiment with active seismic isolation, and recent results. These results include the ability of DAS to record and characterize diverse environmental noise sources, such as wind, tides, temperature variations, and anthropogenic activity like heating, ventilation, and air conditioning systems. Comparisons with conventional seismometers show that DAS achieves comparable sensitivity for the signals observed in this urban setting, underlining its potential as a scalable and cost-effective technology. Looking ahead, this work demonstrates how DAS can enable dense seismic monitoring and contribute to the cancellation of Newtonian noise. This topic will be discussed further in Paul Ophardt's presentation at the ISB ANM board.

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