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Infrasound monitoring system for characterizing the candidate sites of third-generation terrestrial interferometric gravitational-wave detectors

Third-generation terrestrial gravitational-wave detectors, such as the Einstein Telescope and Cosmic Explorer, would offer significantly greater sensitivity and a wider frequency range than existing detectors. Third-generation detectors are designed to be able to detect gravitational waves below 10 Hz. In this frequency range, seismic noise and gravitational gradient noise (also known as Newtonian noise) limit the measurement range of the Einstein Telescope and Cosmic Explorer. The main contributors of Newtonian noise are seismic disturbances, but changes in air density caused by infrasound waves must also be taken into account as a potential sensitivity limiting factor. Therefore, when characterizing potential installation sites for detectors, environmental infrasound must be examined alongside other types of noise, such as seismic and electromagnetic noise. Long-term measurements are necessary to understand changes in infrasonic noise: during the day and at night, on weekdays and weekends, and throughout the changing seasons. Infrasound monitoring systems used for this purpose must be weatherproof and have adequate wind protection. Without wind protection, pressure changes caused by turbulence can override the infrasound.

In my presentation, I will introduce an infrasound monitoring system designed for site characterization measurements of third-generation gravitational-wave detectors. The system was developed by two institutes of the Hungarian Research Network, ATOMKI and Wigner Research Centre for Physics. ATOMKI microphones have already monitored infrasound at the following underground locations: Mátra Gravitational and Geophysical Laboratory (MGGL, Gyöngyösoroszi, Hungary), Sos Enattos mine (Lula, Sardinia, Italy), which is one of the candidate sites for the future Einstein Telescope. One microphone is part of the environmental monitoring system at the VIRGO gravitational-wave detector (Cascina, Italy). Now the microphones have the protection needed for field measurements.

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