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Development of a nested inverted pendulum for ET

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For ground-based GW detectors, seismic vibration is the dominating source of noise in low frequency region (0.1 to 10 Hz), limiting both sensitivity and duty cycle. Thanks to high performant suspension systems, like the Virgo Superattenuator, the presently operational 2nd generation advanced GW antennas have extended their detection band down to 10 Hz. The plan for future 3rd generation detectors, like the Einstein Telescope (ET) aim to further extend the detection band down to 2-3 Hz. This requires, underground locations, where seismic noise is about 100 time smaller than on surface, together to other technological improvements like cryogenic payloads and reduced thermal noise.Anyway to achieve the attenuation value of 10^-18m/sqrt(Hz) at few Hz, the suspensions of the optical components must be upgraded with respect to the 2nd generation ones, in order to improve seismic attenuation in low frequency and reduce as far as possible the frequency of mechanical resonances below the detection band. In this talk, preliminary studies and performances of a seismic isolation system adopting a nested, double inverted pendulum will be presented. Residual motion of the test mass, calculated by combining the transfer function and seismic noise measured at Sos-Enattos site, will be compared with respect the nominal ET's sensitivity curve for evaluating benefits, limits and technological challenges connected to the development of this system,and define requirements for control strategies.

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