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Holding mirrors still for future gravitational wave detectors

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The Einstein Telescope, the future European gravitational wave detector, aims to observe collisions of heavier objects, events deep in cosmological time, and provide early warning for multi-messenger astronomy. To do this it must be sensitive at low frequencies down to 3Hz. However, the current LIGO detectors are limited below 20Hz by sensing and actuation noise from controlling the interferometer. For the Einstein Telescope to reach its design sensitivity from 3Hz onwards a factor of 1 million improvement is needed in the suppression of noises. In this talk I will talk about the necessity for new suspension mechanics and control co-design to leverage and fully account for the strengths and weaknesses of both elements. I will then show how new tools can help us explore the design space to find a solution viable for the Einstein Telescope.

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