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The Challenge of Calibrating a Laser Interferometric Gravitational Wave Detector

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In 2015 the first detection of gravitational waves was made, gravitational waves from the violent collision of two black holes. This collision sent waves through space-time as Einstein predicted. This detection was made possible by many advances in measurement technology, mainly vibration isolation for the detector optics; at 10 Hz, the motion of the laser interferometer detector mirrors is at least on billion times smaller than the seismic motion of the ground and also makes the laser locked-in the detection configuration in a large band of the spectrum. This was made possible by using many feedback and feedforward control loops. But, to reach such requirements more than 100 of such active systems are included in the detectors to allow lock acquisition, lock stability, and sensitivity of the instrument. In this work, the challenges of reaching these requirements will be addressed and how this makes the calibration of these detectors very challenging.

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