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Laser Stabilization Techniques for Gravitational-wave Detectors SERGIO CANTU, MALIK RAKHMANOV, VOLKER QUETSCHKE, Department of Physics, University of Texas at Brownsville — The Laser Interferometer Gravitational-Wave Observatory (LIGO) consists of two 4-km detectors whose mission is to directly observe fluctuations of space-time called gravitational waves. To achieve the necessary sensitivity these detector require precise control of the displacements of many components of the interferometer, and high level of stability of the laser frequency and the purity of laser mode. We present a summary of the experiments with laser stabilization techniques utilized on the LIGO Pre-Modecleaner (PMC) cavity and the Interferometric Displacement Sensor (IDS). The PMC is a triangular ring resonator which suppresses the high order modes in the laser beam, keeping the fundamental mode unaffected, thereby improving the mode content of the laser beam. The IDS based on a simple Michelson interferometer has the sensitivity of 10 fm/rHz which greatly exceeds the sensitivity of the commercial devices (on the order of 10 pm/rHz) which are currently used by LIGO. We measured the performance of both PMC and IDS in table optical interferometer experiments.

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