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Optical Coating Thermal Noise Testbed[1] MICHAEL T. HARTMAN, JOHANNES EICHHOLZ, DAVID B. TANNER, GUIDO MUELLER, University of Florida — Interferometric gravitational-wave detectors measure the length strain of a passing gravitational-wave as differential arm length changes in kilometer-long Michelson interferometers. The second-generation detectors, such as Advanced LIGO (aLIGO), will achieve strain sensitivities which are limited by Brownian thermal noise in the optical coatings of the interferometers' arm-cavity mirror test masses. Brownian coating thermal noise (CTN) is the apparent motion on the mirror surface on the order of $10^{-17} - 10^{-20}$ m resulting from thermal fluctuations in the coating and the coating's internal friction. The result is a source of length noise in optical resonators that is a function of the coating temperature and the coating material's mechanical loss. At the University of Florida we are constructing the THermal noise Optical Resonator (THOR), a testbed for the direct measurement of CTN in the aLIGO test mass coating as well as future coating candidates. The material properties of the coating (namely mechanical loss) are temperature dependent, making cryogenic mirrors a prospect for future gravitational-wave detectors. To explore this option we are simultaneously building a cryogenic CTN testbed, CryoTHOR. This is a presentation on the status of these testbeds.

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