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CryoTHOR: measuring thermal noise in optical coatings GIACOMO CIANI, JOHANNES EICHHOLZ, MICHAEL HARTMAN, GUIDO MUELLER, University of Florida — Brownian thermal noise in the optical coatings of the test mirrors is expected to be one of dominant noise sources in the most sensitive frequency band of the Advanced LIGO detectors, from a few tens to a few hundreds Hz. Together with thermo-optic noise, it is also envisioned to be one of the main obstacles to improving the sensitivity of future gravitational wave observatories, including cryogenic ones. Many groups are currently engaged in the development of advanced coatings designs with reduced noise. Expected performances of such coatings are usually calculated using independent measurements of material properties which enters in the modeling of thermal noise. However, these properties are often highly dependent on the material history and specific geometric arrangement, and their measured values affected by relatively big uncertainties. Furthermore, their temperature dependence is not always well studied. A direct measurement of the thermal noise over a wide range of temperatures is clearly the preferred way of assessing a coating design viability. We report on the design, performance and latest results of cryoTHOR, an experiment developed for the direct measurements of coating thermal noise over the entire LIGO frequency band, both at room and cryogenic temperatures.

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