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Near-field Radiative Coupling for Low-Temperature Gravitational Wave Detectors[1] STACY WISE, V. QUETSCHKE, D.B. TANNER, B.F. WHITING, University of Florida — Future interferometric gravitational-wave detectors will likely be cooled to cryogenic temperatures to produce unprecedented sensitivities. Mirrors serve as test masses for detection of gravitational wave response in instruments such as LIGO, and their internal thermal noise must not prevent measurements from reaching the quantum limit determined by the circulating light power in the interferometer. In order to maintain isolation of the mirrors from ground noise, the cooling should be achieved without physically touching the test masses. Although ordinary thermal radiative emission (Stefan-Boltzmann radiation) is inadequate, if a cold object were brought close enough to the test mass to allow significant electromagnetic coupling via evanescent fields, the heat transfer can increase by several orders of magnitude. The very fact that the cold mass and test mass are coupled creates a path for the introduction of noise mirror motion, and this is also analyzed.

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