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Squeezing in higher-order Hermite-Gaussian modes

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In the design studies of the next-generation gravitational wave detectors, coating Brownian thermal noise is a major noise contribution at frequencies around 100Hz. One proposed method to mitigate this noise source is to use a higher-order laser mode instead of the currently used fundamental Gaussian mode because their more uniform intensity distributions could average better over the mirror surfaces. To maintain the current quantum noise reduction, this would require the efficient generation of continuous squeezed vacuum states in these modes. We aim to demonstrate and compare the direct generation of squeezing in several symmetric Hermite-Gaussian modes and could already measure 7dB of vacuum noise reduction in HG11 as well as 6dB in HG22 in a first test.

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