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Higher-order HG modes for thermal noise reduction

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Thermal noise of the test masses is one of the limiting noise sources in Advanced detectors. It is expected to remain a limiting noise source in future detectors, despite radical changes to the design including cryogenic operations, new materials and the use of longer laser wavelengths. We will discuss progress towards verifying higher-order Hermite-Gauss laser modes as possible alternative or complementary technology to reduce thermal noise. These modes can be made more compatible with realistic imperfect mirror surfaces than the previously considered Laguerre-Gauss modes, and while recent studies show that higher-order modes will be subject to stricter tolerances on alignment and mode matching, this downside may be offset by their correspondingly lower alignment and mode mismatch sensing noise floors.

Primary authors: FULDA, Paul (University of Florida); TAO, Liu (University of Florida); Dr GREEN, Anna (University of Florida)

Presenter: FULDA, Paul (University of Florida)

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