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Faraday Isolator Performance at High Laser Power[1] R.M. MARTIN, V. QUETSCHKE, G. MUELLER, D.H. REITZE, D.B. TANNER, University of Florida — As part of the Advanced LIGO upgrade, optical powers as high as 180 W will be required for increased detection sensitivity. Consequently, optical absorption in the Faraday isolators, as well as aspects like thermal lensing, thermal drift, and thermal birefringence will need to be reconsidered. We performed high power tests on Faraday isolators in two different configurations: first using our self-compensating Faraday rotator with a combination of a thin film polarizer (TFP) and a calcite wedge (CW) and, second, using two identical calcite wedges. In each configuration we investigated optical isolation, thermal drift, and compensation for thermal lensing. We found isolation as high as 39 dB for the TFP/CW and 49 dB for the double wedge at 100 W input power. The isolation ratio is practically power invariant for the first configuration and varies by less than 5 dB over 0–100 W for the second. These measurements were made using a beam diameter of 3.9 mm, within 10 % the value intended for use in Advanced LIGO. Each configuration has advantages; however, both meet requirements for isolation. In order to decide which one will be used in Advanced LIGO, other aspects, like thermal drift, amount of stray light produced, and space available for proper beam separation, should be considered.

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Rodica Martin
University of Florida

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