Abstract Submitted
for the SES10 Meeting of
The American Physical Society

Parallel Phase Modulation for Advanced LIGO[1] MICHAEL T. HARTMAN, BENJAMIN WU, University of Florida, VOLKER QUETSCHKE, University of Texas at Brownsville, MUZAMMIL ARAIN, DAVID REITZE, DAVID TANNER, GUIDO MUELLER, University of Florida — LIGO is a ground based interferometer gravitational wave observatory which attempts to detect gravitational waves by measuring the length changes between its two arms. To operate the interferometer it is necessary to control several longitudinal and angular degrees of freedom of the interferometer. These signals are formed by phase modulation and demodulation of the laser field. Phase modulation introduces frequency sidebands to the carrier laser beam; LIGO requires multiple sidebands to disentangle all the longitudinal and angular signals. The modulation is usually applied by a series of modulators which also generate sidebands around sidebands. Current length and alignment sensing schemes don't require parallel phase modulation, however, if there needed to be a change in the sensing schemes, sidebands of sidebands could limit the performance of LIGO. This talk covers the results of an experiment whose goal is to avoid sidebands of sidebands by modulating the laser in parallel within two arms of a Mach-Zehnder interferometer. In this system, the Mach-Zehnder's arm lengths must be stabilized to meet Advanced LIGO requirements. I will report on the status of this risk reduction activity.

[1]This work is supported by NSF grant 0653582.

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Date submitted: 20 Aug 2010 Electronic form version 1.4