Abstract Submitted
for the APR08 Meeting of
The American Physical Society

New Laser Technologies for Gravitational Wave Detectors MIHAI BONDARESCU, Albert Einstein Institute, RUXANDRA BONDARESCU, Cornell, YANBEI CHEN, Caltech and Albert Einstein Institute, OLEG KOGAN, Caltech, ANDREW LUNDGREN, DAVID TSANG, Cornell — Thermal noise is expected to be the dominant source of noise in the most sensitive frequency band of second generation ground based gravitational wave detectors. Reducing it as much as possible is of paramount importance for increasing detector sensitivity and observing not only gravitational waves, but also quantum phenomena such as entanglement of 40 kg objects. Reshaping the beam to a flatter wider profile which probes more of the mirror surface reduces this noise. The "Mesa" beam shape has been proposed for this purpose and for a long time it has been regarded as the leading low-noise beam for LIGO. We have shown that thermal noise can be reduced by 12% with no additional effort by using finite mirror effects to our advantage rather then working against them. A reduction of 28% can be obtained by reshaping the mirror to coincide with the phase front of the real beam instead of a theoretical beam modeled with infinite mirroers. A drastic reduction in thermal noise by as much as 60% can be obtained by moving away from Mesa altogether and using a beam supported by conical mirrors that resemble the Bessel-Gauss beams. If the maximum 60% reduction in thermal noise is achieved, then in the most sensitive frequency band, LIGO will see up to three times more events.

Mihai Bondarescu
Albert Einstein Institute

Date submitted: 15 Jan 2008 Electronic form version 1.4