

## **LSC Six-Month Progress Report**

**Organization** Institute of Applied Physics (IAP) of the Russian Academy of Sciences  
at Nizhny Novgorod

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Attachment C

Laser/Optics Development Group / Feb 2003 - Aug 2003

- a) A number of optical elements was tested by means of PMWLI. We continued to model the interferometer for in situ measurement of ETM optical thickness. The interferometer may be implemented on LIGO IFO to monitor contamination (installation probably be made in Spring 2004).
- b) Two methods of compensation of thermal lensing in high power terbium gallium garnet Faraday isolators have been investigated in detail: compensation by means of an ordinary negative lens and compensation using FK51 Schott glass possessing a negative  $dn/dT$ . Key thermo-optic constants for TGG crystals and FK51 glass were measured. We find that the contribution of the photo-elastic effect to the total thermal lens cannot be neglected either for TGG or for FK51. We define a figure of merit for compensating glass and show that for FK51, an ordinary negative lens with an optimal focus is more efficient, but requires physical repositioning of the lens for different laser powers. In contrast, the use of FK51 as a compensating element is passive and works at any laser power, but is less effective than simple telescopic compensation. The efficiency of adaptive compensation can be considerably enhanced by using a compensating glass with figure of merit more than 50, a crystal with natural birefringence or gel.
- c) New CW laser with power up to 50W was designed for experimentally modeling of heat deposition in LIGO II Core Optics. Vacuum experiments was continued and obtained data are in a good agreement with numerical calculation.