"DESIGN AND CONSTRUCTION

OF

AN OPTICAL LEVER RECEIVER"

AUGUST PROGRESS REPORT

BY

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The objectives of this project are to analyze, build, and test a prototype optical lever receiver for LIGO. The easy part was to analyze and build the prototype optical lever receiver. However, the main challenge has been to use the receiver in a real experiment and test it. The prototype optical lever receiver was built after successful completion of the computer model. Basically, the prototype optical lever receiver is a 12 inch long black lens tube consisting of lens barrels, spacers and five lenses.

A 1mW laser is used as the beam source. The laser beam is passed through a telescope of magnification 1.7. The telescope increases the size of the optical lever beam, which is essential to get an output beam spot size of 4mm in diameter. The beam then is reflected from the first mirror inclined at 45 degree angle to change the direction of the beam perpendicular to its initial path. A second mirror is used to steer the beam to the optical lever receiver. A rotatable optical flat is placed in between them displace the beam laterally. The beam then is passed through the optical lever receiver, which has quad photo detector attached to the end. The quad photo detector measures the angular deviation. A third mirror is placed at 23 degrees angle with the second mirror and the autocollimator. An autocollimator is used to measure the exact angle of the steering mirror. The quad photo detector is also connected to a voltmeter and an oscilloscope. The voltmeter gives a voltage reading corresponding to the x, y position of the beam on the QPD. The oscilloscope also gives a voltage reading but in a graphical format. The horizontal input angle gives a displacement in x axis and vertical input angle gives displacement in y axis.

The optical lever receiver consists of a two-stage afocal beam reducing telescope, which magnifies angle of the input optical lever beam. The receiver is so sensitive that even slight variation in angle of the input optical lever beam can result in very high magnification, which makes it impossible to get a collimated output beam. Finally, after several days of adjustment we are successful in receiving a collimated output beam with beam spot size of approximately four millimeters, which was extremely essential for processing the experiment to its final stage.

Our next step will be to measure the angular deviation of the optical lever beam using the autocollimator and record the voltage change at each angular deviation using the voltmeter and the oscilloscope. We work together almost everyday for the success of our project.