

## **Feasibility of Using LIGO Facilities as Earth Strainmeters - Some Issues Involved.**

Ronald Drever, Caltech-LIGO

At the LIGO Gravity-Wave Observatory sites at Hanford, WA and Livingston, LA, there are sensitive laser interferometers which monitor the distance in vacuum between pairs of suspended test masses 4 km apart in two perpendicular directions, in terms of the wave length of light from an NdYAG laser. This laser is stabilized to a reference cavity whose length is modulated slightly by adjusting its temperature to partially compensate for the changes in the 4 km baselines arising from earth tides. To use one of these interferometers to monitor earth strain with the highest possible precision would require some additional equipment. This would include at least two systems:-

(a) A system to relate the position of each suspended test mass to some reference point in the ground, which might be done with local interferometers linking the test mass inside the LIGO vacuum system to reference points on the concrete floor of the building or some other ground reference. This would require special design and development, as well as care to avoid compromising the gravity-wave operations. There may be some non-trivial technical problems to be solved.

(b) A system to continuously monitor and record the slowly-varying frequency of the light of from the NdYAG laser, possibly using a stabilized standard reference laser locked to an atomic line. The techniques for doing this are more standard ones, but would require additional equipment.

The need for these additional systems makes it less simple to use the LIGO interferometers as earth strainmeters of high precision than might initially be expected. It may be possible that simpler compromise solutions with lower precision are possible. These would require further investigation.