The Analysis of Spheroidal-Toroidal mode coupling with superconductive gravimeters and strainmeters.

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We have installed a laser strainmeter system in a deep tunnel about 1,000m below the ground surface at Kamioka, Japan. It has been recording crustal deformation since June, 2003. It consists of three types of independent interferometers in the L-shaped vaccum pipes, each of which has a length of 100m. The laser source of strainmeters is a frequency-doubled YAG laser with a wavelength of 532nm. The laser frequency is locked onto an iodine absorption band of saturation spectroscopy and the stability of 2x10^{-13} is obtained. Consequently, quantitative measurement of crustal strains of the order of 10^{-13} can be obtained by employing the laser strainmeter system at Kamioka.

Moreover, we have installed a superconducting gravimeter in the Kamioka Tunnel in 2004. The combined use of highly sensitive laser strainmeters and the superconducting gravimeter(SG) will be an effective tool to investigate geodynamics, for example, separation of spheroidal modes and toroidal modes in the earth's background free oscillation.

At frequences below 3.0mHz, fundamental spheroidal and toroidal modes are coupled strongly and are observed as hybrid multiplets which are shifted in both mean frequency and attenuation rate from the uncoupled values. These fundamental spheroidal-toroidal coupling are dominantly affected by earth's rotation(Masters et al., 1983). If the splitting matrix for Coriolis-coupled spheroidal and toroidal modes can be observed, then the Coriolis terms are linear constraints on the radial distribution of density(Dahlen & Tromp, 1998)

In this research, We compare the spectra of the strain data and the SG data with the records of the Sumatra earthquake of September 2007 at Kamioka, and determine the diferrences of frequency and quality factor of the modes that consist spheroidal-toroidal coupling between the results and PREM to discuss the radial distribution of density.