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The Geosensor Project - measuring true rotations in seismology

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Ring laser measure rotations absolute. When such a gyroscope is made sensitive enough, one can use it to measure rotations associated even with remote earthquakes. Up to now the efforts of some groups to measure rotational movements from teleseismic events have not been successful, because of insufficient sensitivity of the applied measurement devices. During the course of this project, we have built a highly sensitive sensor which also measures rotations from distant earthquakes in one plane. The central component is a Helium-Neon- ring laser. Along with other auxiliary sensors like tiltmeter, seismometer, thermometer and a tight reference to the UTC- timescale it forms a complex measurement device, which allows the quantitative analysis of the measurements. This talk outlines the GEOSENSOR design and discusses its properties. We also report on the installation of a prototype of this instrument at Pinon Flat Observatory in the beginning of 2005. The consistency of the new observable is demonstrated by comparing classical seismometer recordings (i.e., transverse accelerations) with the vertical component of rotation rate. Under certain conditions waveforms should be in phase and amplitudes linearly related by the horizontal phase velocity. This connection is shown for various tele-seismic events.