

The Canterbury Large Ring Laser Project

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Abstract

Rotation sensing is a fundamental aspect of the modern technological society; from length of day determination, aircraft navigation, military applications and even in robotic toys. In this talk I will outline the development of large scale laser gyroscopes (or active laser interferometers) in New Zealand and the current status of the project, science goals, applications and challenges.

We operate helium-neon based, bi-directional ring lasers which are typically square or rectangular cavity designs. They vary in their size from rings whose optical path encloses an area of 1 m^2 , to extreme devices which enclose an area of 834 m^2 . The largest lasers are unsurpassed in their resolution and sensitivity; indeed they are the largest ring lasers in the world. The rotation sensing capability of our most sensitive lasers can be described as equivalent to the ability to detect a rotational velocity of the order of the width of a human hair (say 10 micron) per second, as viewed from a distance of 560 km. The cavity Q (or cavity quality factor) of these lasers is higher than 10^{12} . They are housed in the Cashmere Caverns, an old World War II bunker, thirty metres below the Christchurch suburb of Cashmere, in the 'Port Hills' of the city. The superb mechanical and thermal stability of this site is optimal for the operation of high resolution rotation sensing devices.

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