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Progress in Sagnac Interferometry

Karl Ulrich Schreiber (1), Heiner Igel (2), Joachim Wassermann (2), Andrea Simonelli (2), André Gebauer (2), Jan Kodet (1), and Jon-Paul Wells (3)

(1) Technische Universitaet Muenchen, Forschungseinrichtung Satellitengeodaesie, Geodaetisches Observatorium Wettzell, Bad Koetzting, Germany (schreiber@fs.wettzell.de), (2) Ludwig-Maximilians-University, Department of Earth and Environmental Sciences, Munich, Germany, (3) University of Canterbury, School of Physical and Chemical Sciences, Dodd-Walls Centre for Photonic and Quantum Technologies, Christchurch, New Zealand

Over the year 2017, the large 4 component ring laser ROMY, located about 20 km west of Munich, has been put into operation. ROMY consists of 4 independent triangular equilateral HeNe ring laser gyroscopes 12 m on a side, organized in the shape of a tetrahedron. The corners of each ring are defining the respective scale-factor of each gyro. At each corner of the tetrahedron 3 neighoring rings are rigidly tied together on a solid concrete foundation.

So far all 4 gyros are representing independent free running laser oscillators. Although it is possible to reconstruct the complete global instantaneous Earth rotation axis from this local assembly for the first time, the error margin is currently higher than required for applications in space geodesy. However, this is no fundamental limitation and can be improved in the future by the stabilization of the oscillating laser frequency.

The HeNe gas laser system offers several transitions of laser operation, reaching from the IR wavelength regime to the green (543 nm) in the visible. Although very different in gain and separation with respect to a neighboring transition, they all allow rotation sensing. Since a shorter wavelength translates to higher sensor resolution, it is desirable to operate the system on 543 nm.

This talk summarizes the current performance of the ROMY ring laser structure, compares it to the monolithic G ring laser at the Geodetic Observatory Wettzell and evaluates the operation on a different HeNe transition.