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Detecting an Ether-Wind of 10^-6 of c Based on Sagnac Effect (Updated November 2009)

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This idea comes from a test with atomic clocks connected over some kilometres with coaxial cables. Dr Su[(4)] suggested scaling down and connecting two gas lasers over a few meters with single mode optical fibres. The equipment is mounted on a slowly rotating platform with high mechanical stability. The measurements are made in such a way as to making a *constant and small* frequency difference between lasers irrelevant. Fig. 7 demonstrates the method without synchronized clocks. It is probably the easiest method since light is transmitted in cables and not in open air. This makes

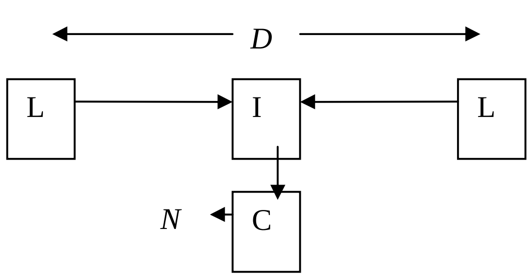

Fig 7 Detecting Sagnac effect on a rotating platform L=Laser C=Counter I=Interferometer *N*=Output from counter (or phase-detector)

sensitivity to vibrations less. The platform rotates slowly around a vertical axis, and the platform must have good stability to avoid vibrations (optical table). Two gas lasers (HeNe) with high frequency stability are used together with mono-mode optical fibres. The difference in laser frequencies is low enough to fall inside the bandwidth of detector and following video amplifier driving a counter. (*N*=Output from counter). Perhaps the lasers must be

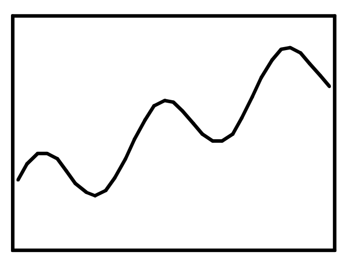

Fig 8 N(t)=Phase difference (counts) as a function of time (t)

individually chosen to the purpose of producing low frequency difference. The equipment is rotated with constant speed. The phase difference between the two signals is a sinus function of azimuth angle or time plus a linear function proportional to the *small* and constant frequency difference between the two lasers. See Fig 8. The counter is not stopped, but output is registered as a function of time. To avoid the ether-wind's effect inside the lasers they are mounted with their cavities in a vertical orientation. With λ=0.63μm (HeNe) D=1or2m should be enough to give significant result. The ether-wind v is derived from data according to the following. (η=Refractive index>1). Ether-wind (v) is given by:

$$\Delta N_{2n} = N_{2n} - \frac{N_{2n+1} + N_{2n-1}}{2}$$

$$\overline{\Delta N} = \frac{1}{n}\sum_{n} \Delta N_{2n}$$

$$\frac{2v}{c} = \frac{\lambda \overline{\Delta N}}{\eta D}$$

Where n is number of samples where two is taken during each period of the rotation. Sampling is assumed when the line between the lasers is pointing east to west or opposite. In reality the sampling must be done with a higher frequency.

The two lasers should be of single frequency type and stabilized in frequency. The frequency drift should be no more than about 2 MHz for a one hour period. The difference is then changed less then 4 Mhz. The lasers should be individually chosen in order to have a difference in frequency that is between 5 and 10 Mhz. The bandwidth of light detecting diode, amplifier and counter should be at least from 0.1 to 20 Mhz. The counter can therefore be simple and must not be able to count both up and down. The counter's reading is registered by a computer as a function of time. To avoid the ether-wind's effect inside the laser cavities the cavities are mounted in a perpendicular orientation in relation to rotation. The time function $N(t)$ is then processed by a Fourier transformation. This demands a *very* constant speed of rotation. The data for frequency stabilized HeNe lasers are good enough to make this method feasible. This question has been given an interesting discussion together with a person[9] having deep professional knowledge about laser technology. It is possible to use this equipment rotating in a vertical plane also. However, the equipment must in such a case be designed to compensate for strain caused by stress

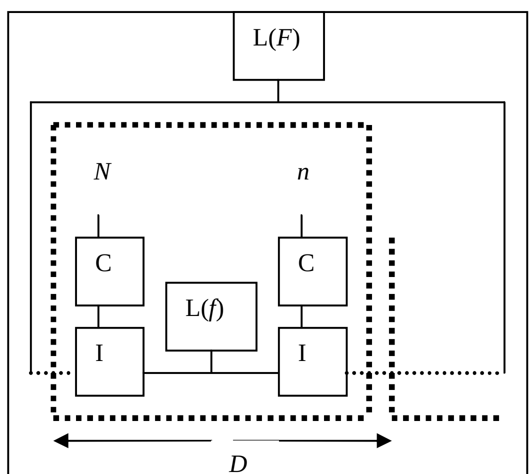

Fig. 9 Method for detection of a natural ether-wind. I= Interferometer L= Laser C= Counter.

from gravitation as much as can be possible.

The demand for constant angular velocity would be fulfilled easily in a low orbit satellite (if the astronauts are not moving to much). The available ether-wind would be 7.8 km/s instead of max 0.465 km/s. The satellite should be rotating around an axis perpendicular to the satellite orbit, and the transmission between the lasers should be in the plane of the satellite orbit. This experiment is very interesting since Michelson's method appears to be silent.

Fig. 9 describes an alternative method, incompletely described in *IE*[(10)] by this author. A laser with frequency *F* is illuminating, by means of fibre optics, a movable equipment from two opposite directions. (Perhaps some kind of lens is needed in the ends of the cables.) The demands on the lasers are the same as in the previous method. Two interferometers compare light from that laser to light from another laser with frequency *f*. The interferometers are feeding two counters. The movable part of the equipment is moved a length, *D*. Both counters are sampled at time t_1, then moved slowly a length D and sampled at time t_2. After that moved back to the first position and sampled at time t_3. A high precision timer must be used to keep:

$t_3 - t_2 = t_2 - t_1$ and v is given by:

$$\Delta N = N_2 - \frac{N_1 + N_3}{2} \qquad \Delta n = n_2 - \frac{n_1 + n_3}{2}$$

$$\frac{2v}{c} = \frac{\lambda}{D}(\Delta N - \Delta n) \text{ test: } (\Delta N \approx -\Delta n)$$

This method can be usable for measuring vertical ether-wind.

References

9. Discussions regarding HeNe lasers together with Nils Abramsson Professor emeritus at KTH (Royal Institute of Technology) Stockholm.
10. J.-E. Persson, The Special Theory of Relativity and the Sagnac Effect, Infinite Energy, Nr 77, Vol 13, 35-40