Null Result for Cahill's 3-Space Gravitational Wave Experiment with Zener Diode Detectors

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Zener diode detectors have been reported to show correlated current output related to the absolute motion of the earth through space [1–4]. Such reports are of utmost importance since it would contradict the Michelson-Morely experiments, the basis of Special Relativity, and connect the randomness of quantum theory with gravitation. Experiments designed to reproduce the reported effects have not seen the reported wave form output or any correlation between Zener diode detectors. Instead we found no detectable signal could be discerned above the noise floor of the digital storage scopes themselves. This does not mean the Cahill's space flow effect does not exist, however the methods reported in the literature do not describe equipment that reproduced the reported measurements.

1 Introduction

Experimental detection of space inhomogeneities flowing at approximately 500 km/sec in the direction of the constellation Vega has been reported [1–3]. Two Zener Diode detectors were oriented in inertial space so that the flow passing first through one detector and subsequently the second detector would produce correlated current output.

A diagram showing a single detector and its circuit diagram copied from reference [1] is shown in Figure 1. The voltage V across the resistor is used to determine the turbulent space flow driven fluctuating tunneling through the Zener diodes. Two such detectors are placed next to each other as shown in Figure 2.

At the bottom of the detector boxes a coaxial cable is shown which in the original experiment connected to a LeCroy Waverunner 6051A 500 MHz, 2 channel 5 Gs/sec Digital Storage Oscilloscope (DSO), which was used to record and display the two resistor voltage measurements. Correlated voltage from the two collocated detectors reported in reference [1] and [2] are shown in Fig 3.

A clear correlation is indicated by the wave forms of approximately 200 MHz along with some noise. A similar diagram with the two wave forms 180° out of phase was reported when the alignment of the two detectors was reversed so that one coaxial lead came out the top while the second one came out the bottom.

The correlation presumed by R. Cahill is due to structure in the flow which passed through each diode in the detectors. When the detectors were separated by 25 cm and aligned in direction RA=5 h, Dec=-80 deg similar correlation diagrams were shown but required a delay of 0.48 μs to compensate for the flow speed estimated to be 520 km/s from these measurements.

The simplicity of the detectors and the obvious correlated wave forms along with the enormous significance of these

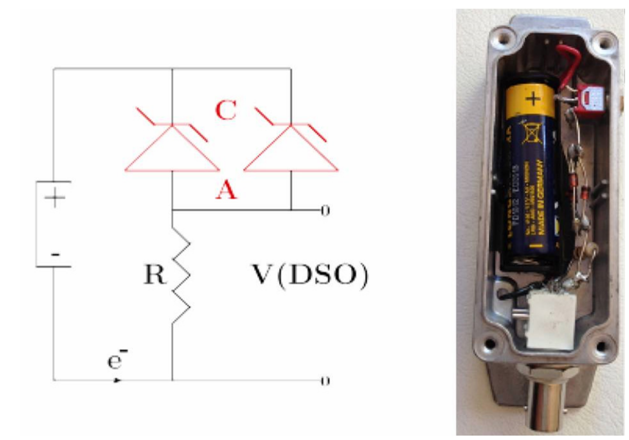

Fig. 1: Left: Circuit of Zener Diode Space Flow Detector, showing a 1.5 V AA battery, two 1N4728A Zener diodes operating in reverse bias mode, having a Zener voltage of 3.3 V, and resistor R=10 kΩ [2].

Fig. 2: Two collocated detectors.

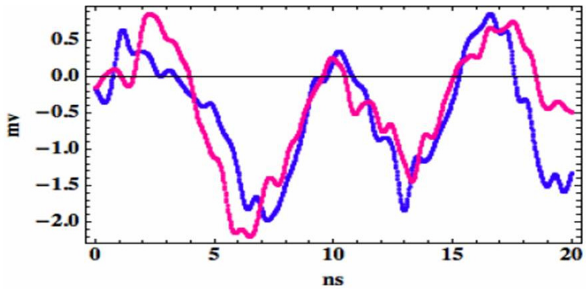

Fig. 3: Correlated current fluctuations as indicated by voltage across resistor R and with DSO operated with 1 MΩ AC input, and no Filters.

Fig. 4: Two Zener diode detectors.

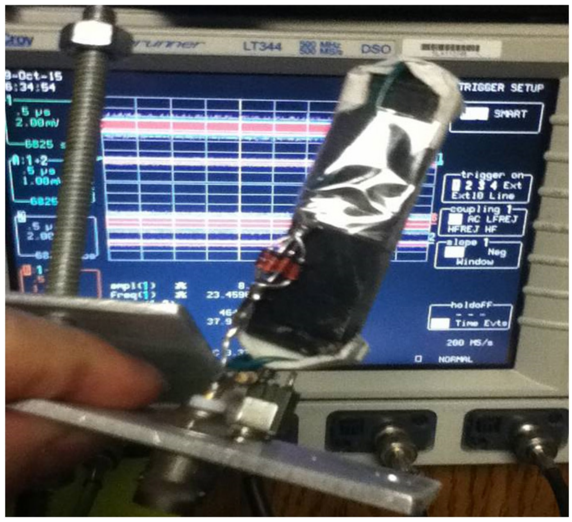

Fig. 5: Detector in front of DSO.

reported experiments encouraged us to attempt a verification experiment.

2 Initial verification experiment

The straight forward verification of the Space Flow Detectors was a simple experiment which consisted of building two Space Flow Detectors, connect their two channels to a DSO, move the detectors around a Southerly direction and watch the sum and difference signals on the screen. A qualitative indicator of signal correlation would show a small difference reading for the difference display and relatively large amplitudes in the sum display. Such oscilloscope comparisons are easy to make, and if seen would be the initial indicator that the equipment was functioning properly and the hoped for space flow could be measured.

The initial work was done in E. Reiter's lab. Figure 4 shows the two detectors. Each one has two Zener Diodes closely packed together. The bottom metal square shows the coaxial cable connection. In the left corner the metal shielding tube can be seen. In operation the detectors are completely encased in metal shielding so any external electromagnetic signals would be attenuated all the way to the DSO's two input channels. The initial correlation search experiment was run over many trials, days, orientations, and separation distances.

We also built detectors with more diodes packed in a cluster. A side view of a single detector with 5 z-diodes, in front of the LeCroy Waverunner LT344 500 MHz, 4 channel, 500 Ms/sec DSO, is seen in Figure 5.

No evidence of correlation could be detected. A typical screen shot of the DSO front panel showing Channels 1 and 2, at the first and fourth trace, is shown in Figure 6.

The second and third traces shows an amplified difference and sum trace. These traces show noise without discernible amplitude differences we would expect if correlations were present.

Using the storage facility of the DSO, E. Reiter searched for signals. A typical report reads: "I'm looking at diode noise for 10 div × 20 sec × 1412 sweeps = 282400 s = 3.2 days. It is just non-interesting noise. Trigger is at 0.32 millivolts. I also searched with the trigger at 1 mV to see if there were periodicities; there were none."

We had not seen any indication of either a correlated signal or a periodic wave form as reported in the literature. We must assume something was wrong with our equipment or technique. To get to the bottom of the problem we contacted Prof. Cahill, who helped us diagnose our experimental setup.

3 Configuration refinement

The details of the actual phenomena had to be examined to determine whether any features could be detected. The earth is moving at roughly 500 km/s toward the direction RA=5 h, Dec=-80 deg. Figure 7 shows a space flow coming from the southerly direction. In this orientation the flow past our detectors should be in parallel so that no time delay would be encountered. However if the orientation to the South Sidereal Pole is offset by θ degrees when the spacing between the detector clusters is "d"centimeters then the time delay is

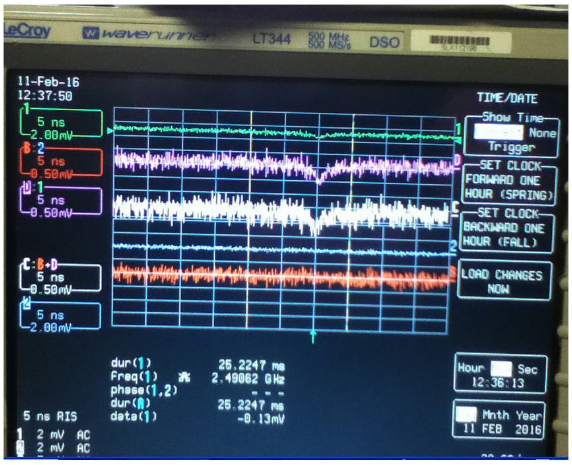

Fig. 6: Typical DSO trace.

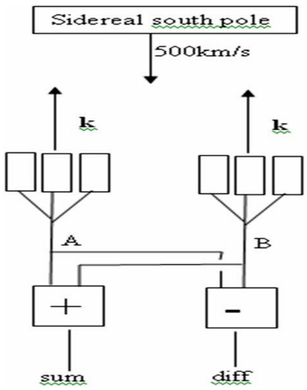

Fig. 7: Detector configuration.

calculated by

$$t = \frac{d\ \sin(\theta)}{500\ \text{km/sec}}. \tag{1}$$

For a typical spacing of d=5 cm between side by side shielded detectors with an angle of $\theta = 30°$, the delay is 50 ns. The delay time for a 25 cm spacing would be on the order of 250 ns at 30° angle and 500 ns at 90°. This time delay of 0.5 μs corresponds to side by side direction pointing to the Sidereal South Pole and was also calculated in reference [3, Fig. 28].

Wave features similar to those shown in Figure 3 above where published showing wave features with approximate periodicities, of 10 ns in reference [1] Fig. 5, of 100 ns in references [2] Fig. 5, of 6 ns reference [1] Fig. 4, and 200 to 300 ns in reference [3] Fig. 28.

From this analysis it can be concluded that with a 500 Msamples/sec scope all but the highest frequency features reported would be adequately sampled to allow simple correlation. The time delay issue is more critical. Features with a structure on the order of 10 ns can only be convincingly correlated using our sum-difference strategy when the delay between the signals A and B in Fig. 7 is on the order of 1 ns. Using eq. 1 and assuming that the packaging distance "d" is limited to 2 cm the alignment angle must be controlled to,

$$1.4° = \arcsin\left(\frac{1\ \text{ns} \cdot 500\ \text{km/s}}{2\ \text{cm}}\right). \tag{2}$$

This is not only a difficult orientation tolerance to maintain but the 1.4° angle at 2 cm spacing corresponds to 1.4 mm linear distance by which the diodes must be aligned with each other in a cluster. If the packaging could be reduced to half a centimeter and the time delay restriction relaxed to 2 ns we would get an angular tolerance of 11.5°. This is an orientation tolerance that could be met with fairly primitive equipment.

During our communications with Prof. Cahill many additional possible error sources were discussed. Improper cabling allowing EM radiation from external sources could explain sinusoidal wave forms. This possibility was soundly rejected by Prof. Cahill. Whether additional data processing was used to searched for correlations in oder to achieve the results was also denied. Cherry picking of accidental correlations to show in the reported papers was also denied. Prof. Cahill claimed to have observed consistent and reproducible correlation measurements many times.

We explored the possibility of borrowing the detectors to explore any differences in construction but such an exchange was rejected as time consuming due to the requirements of export regulations. This left some additional theoretical questions. We wondered about the size of the features in both time and space that were predicted. Since correlations were found between well separated detectors after time delay adjustment and time features of between 5 and 200 ns were routinely measured by Prof. Cahill. This could not be a problem.

Could the earth mass between the detector location and the Sidereal South pole attenuate the space flow signals more in the northern hemisphere than the south? A mass shielding effect was not considered likely from Cahills theory and because measurements of the effect were reported involving random number generators in Europe. Therefore the improvement in the three design features discussed above were left to consider when designing a follow on experiment.

4 Follow on experiment design

A repetition of the experiment was planned with the following changes:

1. Collocated detector design with minimum Zener Diode distances
2. careful alignment of the diode cluster to less than 1 mm
3. Less than 10° orientation with the direction of the expected velocity vector.

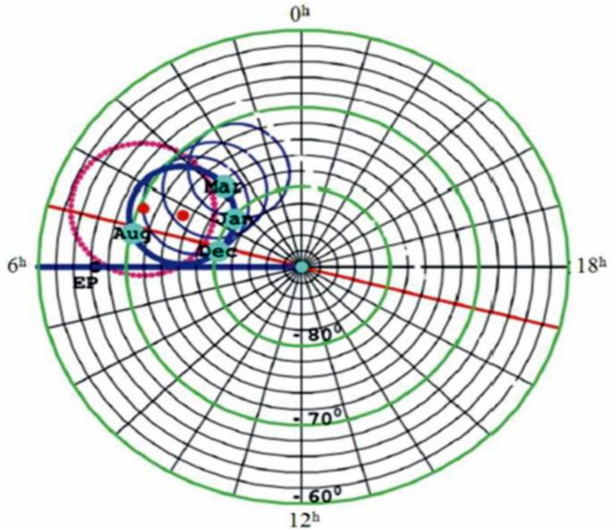

Fig. 8: Earth motion directions [3].

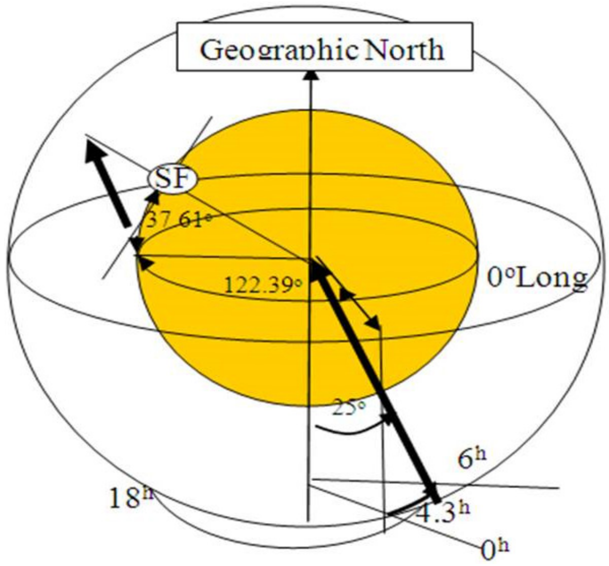

Fig. 9: Sidereal geography.

4.1 Orientation in inertial space

Fig. 8 shows the Sidereal South pole region. The right dot (red) at RA=4.3 h, Dec=75°S is the direction of motion of the solar system through space with a speed of 486 km/s as determined from NASA spacecraft earth-flyby Doppler shifts. The thick circle centered on this direction is the observed velocity direction for different days of the year. Relative to the earth location of the San Francisco Airport is 37.61 latitude and -122.39 longitude.

Figure 9 shows the Earth with San Francisco (SF) on the left edge. The local time in San Fransisco is 3.8 h AM and the Greenwich Meridian 122.39° toward the East is at 0 h. The Sidereal south pole is 4.3 h or 64.5° further east and 75° south latitude. The bold arrow shows the direction of the earth motion pointing toward the center of the earth. The parallel velocity vector at that time will point down toward an elliptic path.

4.2 Detector configuration

A stand placed flat on the ground aligned to geographic North, with a beam pointing down toward the ellipse marked by local time of day shows the direction of the Sidereal South Pole from San Francisco.

A dual detector is aligned so the Zener diodes clusters are correctly aligned to intercept the Flow vector as nearly perpendicular as possible.

The dual detector assembly was constructed with two single Zener diodes, mounted in a sealed metal box to eliminate external noise so that the entire assembly could be oriented perpendicular to the presumed space flow. A variable battery voltage supply was introduced to allow us to adjust the voltage close to the reverse bias breakdown voltage and thereby maximize the expected noise output. Dip switch jumpers were added to allow multiple circuit configurations of the circuit shown in Figure 11.

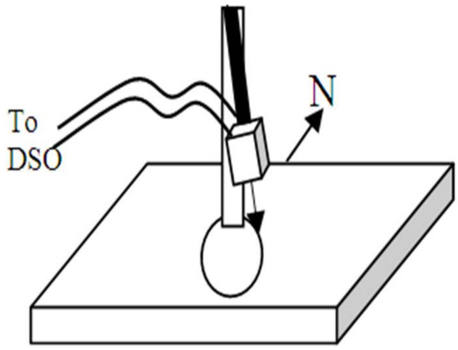

Fig. 10: Detector stand.

With this new detector we began calibrating the variable battery voltage to determine the optimum noise output before attempting space flow alignment.

4.3 Experimental result

To our surprise we could not determine any sensitivity of output noise level. The noise level remained the same even when the battery power was completely turned off. In fact after first disconnecting the battery and then disconnecting the Detector from the DSO and replacing the cables with terminators placed directly on the oscilloscope input connector no difference in noise level showed. We had all along been attempting to find correlations between internally generated DSO noise.

Could Dr. Cahill have used a white noise amplifier [5] in his circuit and simply failed to mention the fact? He claimed no amplifier was used but did acknowledge that he had dis-

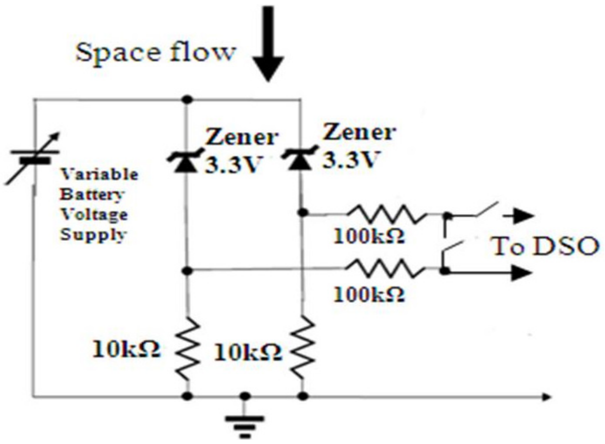

Fig. 11: Dual detector.

covered a space flow correlation simply between DSO devices and sent us the article [6]. We separately tested a second available DSO to verify the noise output when

(a) no detector was attached,

(b) no battery was in the detector, and

(c) everything was connected as described in the literature.

We performed sum and difference signal testing on the two input channels to see if any correlation between the noise sources existed. These experiments also showed nothing. FFT analysis of the signals only showed power at frequencies corresponding to wi-fi routers. Leakage from these high frequency signals were surprisingly difficult to eliminate but clearly not due to Zener diode noise.

5 Conclusion

We have attempted to verify the space flow detector experiment reported by Dr. Cahill which reported an effect that is consistent with the absolute motion of the earth through inertial space. Our conclusions are:

1. Zener Diode circuits without a white noise amplifier could not provide the signal levels reported in the literature as duplicated here in Figure 3.
2. Nothing in any signals produced by Zener diodes in reverse bias mode contains substantial power at frequencies whether of the 7ns periods or any others published by Dr. Cahill.
3. Internal Noise by Zener Diodes or other components in DSO equipment may be the source of the signals reported by Dr. Cahill.
4. There is no indication any signals generated by equipment reported by Dr. Cahill in the literature contains correlations that can support the space flow hypothesis.

No statement is made here regarding the theory of space flow as proposed by R. Cahill. There are other experiments supporting similar theoretical results [7] are also controversial [8]. Only the ability to detect space flow with the Zener diode detector design reported by Cahill in the literature has been tested.

In order to further explore the possibility that a Cahill type space flow disturbance may exist and may have a detectable effect on quantum devices it will be necessary to repeat Dr. Cahill's correlation experiments augmented by white noise amplifiers, statistical correlation software, and adequate shielding tested to eliminate any possibility of local signal corruption.

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