Attempt to Replicate Cahill's Quantum Gravity Experiment to Measure Absolute Velocity

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In December 2015 in a laboratory in Longmont, Colorado, USA, I attempted to repeat the experiments of Reginald T. Cahill for detecting dynamical space by using reverse biased Zener diodes as quantum tunnelling devices whose tunnelling currents are modulated by the motion of dynamical space relative to the earth. I successfully produced the correlated signals of the same frequency and amplitude as Cahill has produced in his laboratory in Adelaide, Australia. But I determined that rather than being disturbances in space, these signals were merely transient responses to local electromagnetic disturbances which appeared to be correlated due to the identical natural frequencies of the two detectors. This paper is a report on those experiments.

1 Introduction

Recent papers by Cahill [1–3] discuss gravity wave detection using reverse-biased Zener diodes as "quantum gravitational wave detectors". In December 2015, in Longmont, Colorado, I built these quantum wave detectors using the identical parts and schematic as Cahill in order to confirm his measurements. I consulted with Cahill via email to make sure they were exactly as he designed them.

Fig. 1: Inside of Quantum Detector used in experiment.

Figure 1 shows a photograph of the inside one of the quantum detectors used in the experiment. It consists of a parallel connected array of three 3.0 V 1N4728 Zener diodes serially connected to a 1.5 V battery and a 10 kOhm sense resistor. The voltage across the sense resistor goes through a BNC connector and a 3 ft. RG58 coax cable to the AC-coupled input of a LeCroy 1 GHz bandwidth Digital Sampling Oscilloscope (DSO). The schematic and a picture of the inside of Cahill's detector can be seen in Figure 1 of [1].

Figure 2 shows the detector after it has been sealed up inside an aluminum case and connected to the coax cable that goes to the DSO input.

In my correspondence with Cahill in December 2015, he was kind enough to take some additional measurements and send me the oscilloscope pictures of the correlated quantum waves he is detecting in his laboratory in Adalaide, Australia.

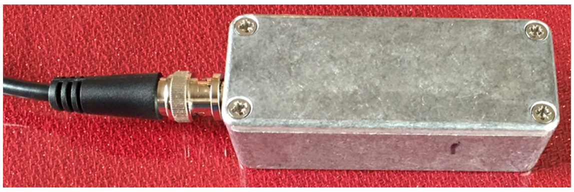

Fig. 2: Enclosed Quantum Detector used in experiment.

I was able to capture nearly identical correlated signals in my laboratory in Longmont, Colorado. However, upon further investigation of these signals I determined that they were of local origin and that the frequency of the waveforms was tied to the resonant frequency of the detector-cable system. I have concluded that the "correlation" Cahill sees is only an apparent correlation because the circuits of the two detectors, when excited by an external disturbance, produce nearly the same transient response due to their being nearly identical circuits with nearly the same natural frequency. An external disturbance, such as a nearby static discharge is required to excite the transient response. The correlated signals start out in phase but slip with time because the two resonant frequencies are not exactly the same. The measured phase difference is simply a function of how much time elapses from the moment of excitation until the scope triggers and captures the waveforms.

This paper documents the experiments I performed and my reasoning for coming to the above conclusions.

2 Cahill's data

Figures 3 and 4 show data from Dec. 13 and 14, 2015, taken by Cahill in his laboratory in Adelaide, Australia, and sent to me via email as an example of what the current fluctuations from the gravity waves look like for collocated detectors. Similar pictures of gravity waves in his detectors can be seen in [1–3]. Notice that the frequencies in these two

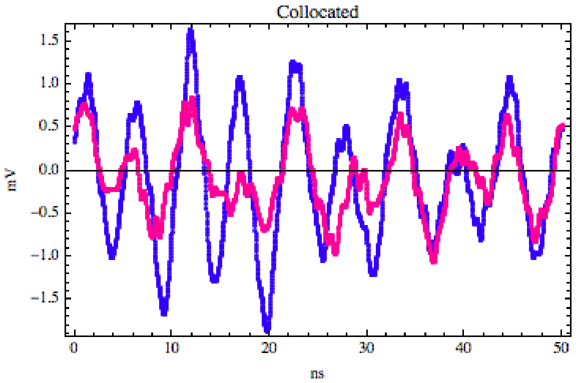

Fig. 3: Cahill Dec 13 Typical Data with detectors collocated.

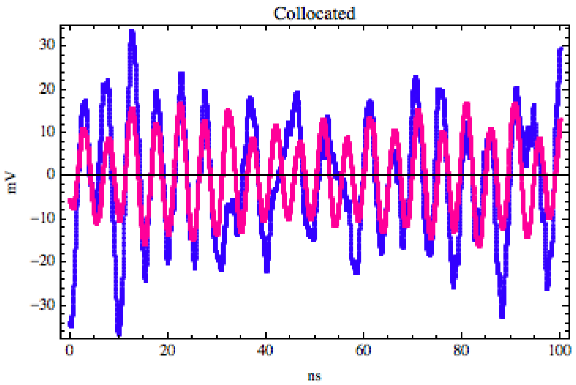

Fig. 4: Cahill Dec 14 Typical Data with detectors collocated.

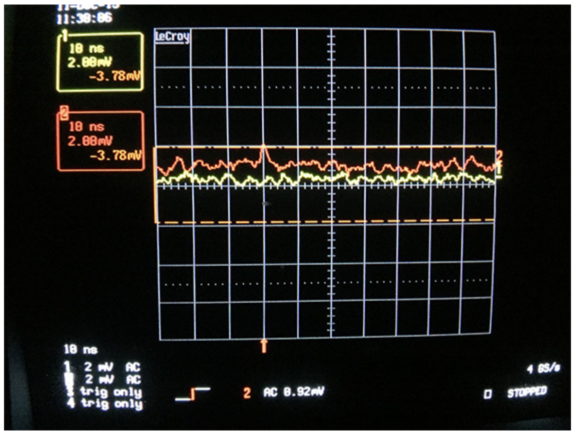

Fig. 5: Quiescent waveforms of collocated detectors.

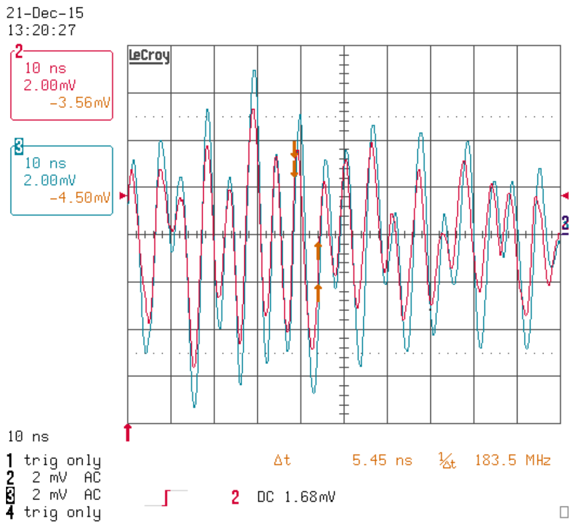

Fig. 6: Burst of energy from collocated detectors in my laboratory on Dec. 21, 2015.

plots are near 200 MHz and appear almost like a tone superimposed on noise. This seemed odd to me given that Cahill in his papers says that the frequency spectrum of the fluctuations in the detectors has a 1/f amplitude relationship. The reason the tone seen in his data does not show up in the frequency spectrum plots, is because they occur so infrequently. Most of the time the current fluctuations are at very small quiescent levels that look like random, uncorrelated noise. This quiescent current is disturbed at random periods by bursts of energy at mostly a single frequency, which are the waveforms captured in Cahill's pictures. Because these energy bursts are short with long periods of time between them, they have little effect on the Fourier transform over a wide frequency band — hence the 1/f relationship without evidence of these tones.

3 My experimental data

Figure 5 is a photo of my oscilloscope on Dec. 11, 2015, showing the quiescent signal from the detectors. Notice that there is little, if any, evidence of correlation between the two waveforms. The scale is 2 mV per division vertically and 10 ns per division horizontally. Notice also that the peak-to-peak fluctuations are typically less than 1 mV.

On December 11, when I took the picture in Figure 5, I was unable to detect any signals except the quiescent current. I tried various orientations of the detectors but gave up after a few hours of searching. After communicating with Cahill via email, he sent me the pictures of Figures 3 and 4 showing me what he was seeing in his laboratory. I then went back into my laboratory on Dec 21 and set up my oscilloscope to trigger on any signals above 1.5 mV. After several minutes, I suddenly got a large burst of energy at about 200 MHz just like Cahill. This is shown in Figure 6.

The fundamental frequency of this waveform is highly correlated between the two detectors. However, I noticed a subtle difference between the two waveforms that should not be there if they are truly being modulated by the same source. The phase of the two waveforms is nearly perfectly aligned on the left side of the screen but it is drifting apart as one moves towards the right side of the screen. This is what one would see if two different, but nearly identical frequencies were observed. It is not what one would see from a single modulating

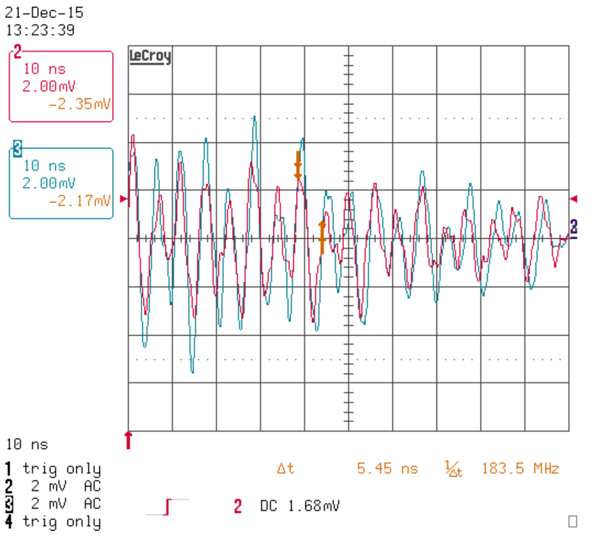

Fig. 7: Another captured waveform from collocated detectors in my laboratory on Dec. 21, 2015.

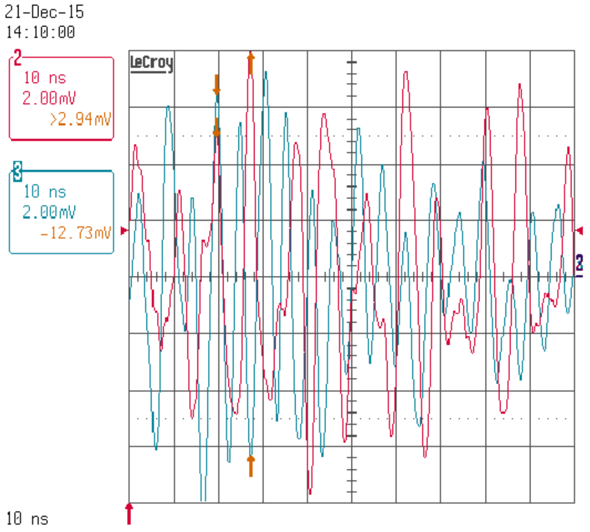

Fig. 8: Waveforms from collocated detectors with different cable lengths.

source observed on two different detectors.

I set the scope up to capture another signal and got the waveform shown in Figure 7. Notice again the same effect. The phase is aligned on the left and is slowly drifting apart as it moves to the right. If collocated detectors were being excited by the exact same gravity waves, the phase between them would not drift. At this point I realized that something was not right. My first suspicion was that my two "identical" detectors were not quite identical, but had natural frequencies in their circuits (including the cables) that were not quite the same. They were being excited by some external signal, but the actual response I was seeing was not a gravity wave, but simply the transient response of each of these circuits as they resonated at their not-quite-equal natural frequencies.

To test this theory, I replaced the cable on one of the detectors with a longer cable. I now had a 3 ft. coax cable on the detector going to channel 3 (blue) of the scope and a 5 ft. cable on channel 2 (red). The result was the waveforms shown in Figure 8. This shows very clearly that the red waveform has a fundamental frequency significantly lower than the blue waveform. I had proof positive that these 200 MHz energy bursts were not from 200 MHz gravity waves.

But there was still the question of what caused the excitation of the circuits to start with. Could it be Cahill's gravity waves that provide the initial excitation? Or was the source of local origin? My next experiment was to separate the detectors by a few millimeters to see if the phases of the two waveforms would start out with an initial phase difference. This is what would happen if they were being exited by passing through Cahill's gravity waves due to the velocity of space past the earth. Cahill asserts that the velocity of the earth is about 500 km/sec which represents about 2 ns/mm in phase shift if the detectors are directly aligned with this velocity. If they are not aligned, an even larger phase shift per mm would be observed. I saw no change in the phase relationship between the two signals as the detectors were moved relative to each other. The waveforms remained in phase at the beginning and drifted with time. This indicates an initial excitation disturbance moving at the velocity of light — not 500 km/sec.

In [4], Vrba noted that the battery, diode and resistor circuit form an electromagnetic wave sensing loop having a substantial cross section. Although the circuit is enclosed inside an aluminum box that shields electric fields, it is not a perfect shield. It will highly attenuate an electromagnetic wave, but with the oscilloscope set to its most sensitive level of 2 mV per division, even an attenuated signal could still be large enough to be detected.*

As I was pondering how to identify the source of the initial excitation, I noticed something very interesting. My oscilloscope would not trigger unless there were people in the laboratory. If everyone left and there was no nearby human activity, the signals would remain at their quiescent (< 1.4 mV) level and the scope would never trigger. But once nearby human activity resumed the scope would begin triggering again every few minutes. It didn't take long to find a correlation between static discharges from human activity and the energy bursts in the scope. By experimenting, I found that I could generate a frequency burst that would trigger the scope from as far away as 20 meters by shuffling my shoes on the car-

*Although not reported in this paper, I designed a second experiment using an architecture similar to Vrba's. It included 200× amplification with a bandwidth of 10 MHz to detect even smaller signals. The resonant disturbances disappeared, which left only the random noise. Visually examining these waveforms, I saw no evidence of correlated signals. The raw data files are available upon request at the email address given above for anyone desiring to perform a more sophisticated search for correlation between the waveforms.

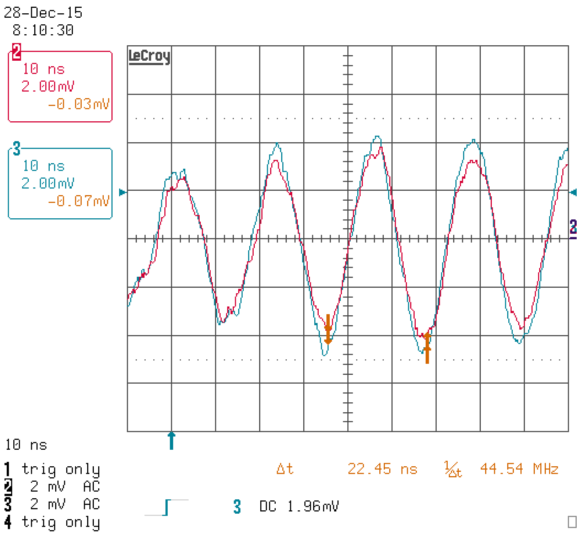

Fig. 9: Waveforms from collocated detectors with battery bypassed with 1 nF capacitor.

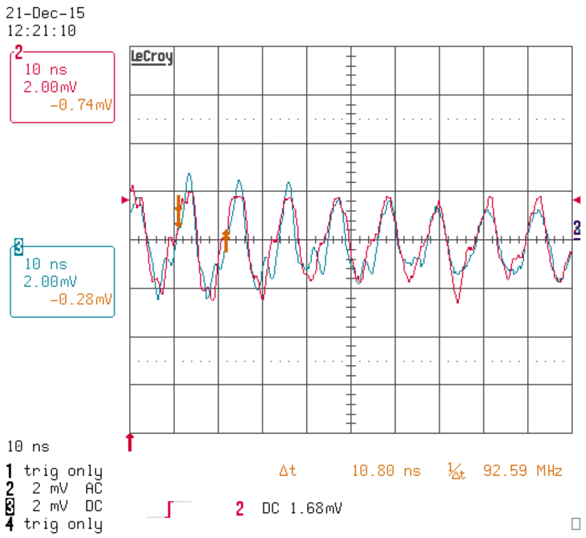

Fig. 10: Waveforms from collocated disconnected coax cables.

pet and touching something metallic. The waveforms looked identical in amplitude and frequency to those above.

As an additional proof that the detected frequency was entirely determined by the circuit, I made 2 modifications to the circuit. First, I put a 1 nF capacitor across the battery to provide a low impedance path for high frequencies. It caused the frequency of the transient response to drop to below 50 MHz as shown in Figure 9. I then removed the quantum detector entirely, and just left the two 3-foot, collocated coax cables disconnected. The waveforms are shown in Figure 10. These results further strengthen the argument that the frequency of the waveforms are determined entirely by the circuit itself.

4 Conclusions

After attempting to repeat the gravity wave detection experiments of Cahill using reverse biased Zener diodes as quantum tunnelling devices, I found no evidence of current fluctuations due to anything but normal random noise or local disturbances followed by a transient oscillation at the natural frequency of the detector circuits. The so-called correlation of the signals between detectors was merely an apparent correlation due to the fact that the circuits have natural frequencies that are nearly identical. This was proven by changing the natural frequencies of the circuits and showing that the frequency of the "gravity waves" changed to the new frequency.

The initial excitation of the circuits was shown to be from local sources — not disturbances in "dynamical space" as proposed by Cahill. The detectors exhibited no evidence of being excited by anything but uncorrelated random noise unless nearby human activity was generating static discharges. No evidence of any correlated signals between detectors was ever seen at any frequency other than the natural frequency of the detector circuits (superimposed on noise and/or reflections in the cables).

Whether Cahill has ever detected disturbances due to dynamical space, I cannot say. But I am satisfied that in Longmont, Colorado in December of 2015, there was no evidence that dynamical space was detectable using the Zener diode circuit Cahill has proposed in his papers.

Acknowledgements

I am indebted to Reg Cahill for his assistance in getting the quantum detectors built properly, providing advice on how to detect the signals and in supplying me with examples of the signals he obtained in his laboratory. It is unfortunate that my experiments ended up contradicting his papers rather than confirming them.

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