Nanotechnology Quantum Detectors for Gravitational Waves: Adelaide to London Correlations Observed

Reginald T. Cahill

School of Chemical and Physical Sciences, Flinders University, Adelaide 5001, Australia. E-mail: reg.cahill@flinders.edu.au

The discovery of the nanotechnology zener diode quantum detector effect for gravitational waves is reported, based upon the quantum to classical transition being induced by dynamical 3-space fluctuations. Gravitational waves were detected by way of waveform correlations between time measurement in two Digital Storage Oscilloscopes, revealing time delays of 13 to 20 seconds over 24 hrs for Adelaide to London travel, varying as the earth rotates. The speed and direction were found, for January 1, 2013, to be 512 km/s, RA = 4.8 hrs, Dec = 83 deg S. This velocity agrees with previous detections using different techniques, such as the NASA spacecraft Earth-flyby Doppler shifts, which found 491 km/s, RA = 5.2 hrs, Dec = 80 deg S, for December 8, 1992. Consequently it was realised that nanotechnology zener diode quantum detectors have been operating, for different reasons, for some 15 years, and are known as RNGs (Random Number Generators) or REGs (Random Event Generators). The discovery herein reveals that they are not random. Correlations between data from a REG in Perth and a REG in London gave the speed and direction, for January 1, 2013, to be 528 km/s, RA = 5.3 hrs, Dec = 81 deg S. We also report highly correlated current fluctuations from collocated zener diode circuits. The GCP REG network constitutes an international gravitational wave detector network, with currently some 60 REGs operating, and with records going back to 1998. These detectors permit the study of dynamical 3-space structure, and also apparent anomalous scattering of the waves when passing deeper into the earth, solar flares, coronal mass ejections, earthquakes, and correlations with fluctuations in various rate processes such as nuclear decays. The quantum to classical transition is shown to be caused by 3-space dynamics, and so challenges the standard interpretation of probabilities in quantum theory.

1 Introduction

The speed and direction of gravitational waves have been directly measured via waveform time delays from detectors located in Adelaide and London, and separately from Perth and London. The Adelaide to London correlations were detected utilising the discovery that so-called “clock jitter” in two digital storage oscilloscopes (DSO) is actually correlated, with the London signal delayed relative to the Adelaide signal by 13 to 20 seconds, depending on sidereal time, so that at least part of the clock jitter is actually induced by passing gravitational waves. Subsequently similar correlations were discovered in Random Event Generator (REG) correlated data. These detect the quantum to classical transition for electrons tunnelling through a barrier in a tunnel diode, a nanotechnology device. According to the standard interpretation of quantum theory such electron current fluctuations should be completely random, which is why such devices are also known as hardware Random Number Generators (RNG), and have a variety of applications assuming such randomness.

These discoveries make the detection and study of gravitational waves particularly simple, and easily extend to a network of detectors, and for the REG technique an international network of such detectors has existed since 1998, and so that data is an extremely valuable to the characterisation of the gravitational wave effect, and also other phenomena which appear to be induced by more extreme fluctuations. Correlations of the gravitational wave forms permit determination of the speed and direction of space, which agrees with results from NASA Earth-flyby Doppler shift data, and with the 1925/26 Dayton Miller Mt.Wilson gas-mode Michelson interferometer data. The correlation data also reveals two new phenomena: a speed-up when the waves pass deeper into the earth, and a wave reverberation effect. For collocated zener diodes the current fluctuations are highly correlated, with no time delay effects, as expected. The quantum to classical transition is thus shown to be caused by 3-space dynamics, and so challenges the standard interpretation of probabilities in quantum theory.

2 Classical physics gravitational wave detectors

Classical gravitational wave detectors have employed a number of physical effects and designs: gas-mode Michelson interferometers, optical fibre Michelson interferometers, RF coaxial cable travel time differential measurements, and more compact RF coaxial cable – optical fibre measurements, spacecraft Earth-flyby Doppler effects, and dual RF coaxial cable travel time measurements [1,2]. All of these techniques utilise light or EMR anisotropy speed effect in a single device.

The key issue with such devices is that they are single-site devices, and require a calibration theory, which depends upon an assumed theory. For example the sensitivity of a Michelson interferometer, as indicated by the travel time difference between the two arms, and detected by means of fringe shifts as the detector is rotated, is given by

$$\Delta t = k^2 \frac{Lv_P^2}{c^3} \cos(2(\theta - \psi)) \tag{1}$$

where L is the arm length, v_P is the speed projected onto the plane of the interferometer, and the angles measure the rotation effect, see [1]. Eqn.(1) is applied to the data in conjunction with terms accounting for the inclined mirrors and temperature drift effects [1]. The critical factor k^2 is the calibration constant. With a gas present in the light path, with refractive index n, $k^2 \approx n^2 - 1$ to a good approximation. Results from two gas-mode Michelson interferometer experiments are shown in Fig. 1. The results reveal significant turbulence, which has been identified as gravitational waves, and much greater in magnitude than expected. Michelson and Morley in the 1st such experiment in 1887 assumed that $k^2 = 1$, whereas with air present, $n = 1.00029$, giving $k^2 \approx 0.0006$, and so much less sensitive than assumed. Note that a vacuum-mode Michelson interferometer has $k^2 = 0$, and so completely insensitive to gravitational waves.

A recent gravitational wave experiment used differential travel time measurements in a dual RF coaxial cable array [2]. This technique relies upon the absence of Fresnel drag in RF coaxial cables, at least for low RF frequencies (~10 MHz). The results agree with those form the Miller gas-mode Michelson interferometer, and from the NASA flyby Doppler shift data. The fluctuations were again observed to be a ~20% effect.

The interpretation of the magnitude of the detected effects in these classical detector experiments all rely upon some calibration theory, and there has always been confusion. Fortunately spacecraft flyby Doppler shift analysis does not suffer from such problems, and has indeed confirmed the results from the classical detectors. We now report the discovery that nanotechnology quantum detectors respond to the fluctuations of the passing space, and when the data from two well-separated detectors is subject to a correlation analysis of the two local waveforms the average speed and direction of the passing space is revealed, together with significant wave/turbulence effects. This technique gives an absolute measurement of travel times.

3 Quantum gravitational wave detectors

When extending the Dual RF Coaxial Cable Detector experiment to include one located in London, in addition to that located in Adelaide, an analysis of the measured DSO internal noise in each identically setup instrument was undertaken, when the extensive RF coaxial cable array was replaced by

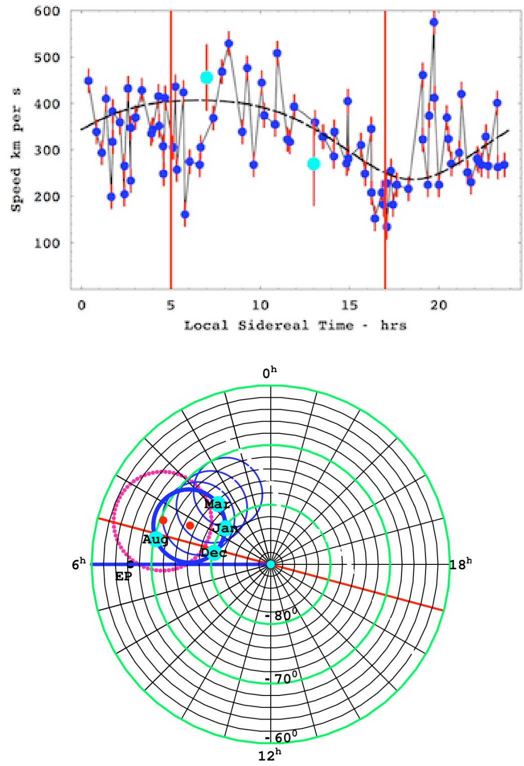

Fig. 1: Top: Speeds v_P, of the space velocity **v** projected onto the horizontal plane of the Miller gas-mode Michelson interferometer located atop Mt.Wilson, plotted against local sidereal, for a composite day, with data collected over a number of days in September 1925, see [1]. The data shows considerable fluctuations, from hour to hour, and also day to day, as this is a composite day. The dashed curve shows the non-fluctuating best-fit variation over one day, as the earth rotates, causing the projection onto the plane of the interferometer of the velocity of the average direction of the space flow to change. The maximum projected speed from the curve is 417 km/s, corresponding to a speed of 453 km/s, with a RA of ~5 hrs, which is very close to results reported herein. The Cassini flyby Doppler shift data in August 1999 gives a RA = 5.2 hrs [1]. The green data points, with error bars, at 7 hrs and 13 hrs, are from the Michelson-Morley 1887 data. The ~20% speed fluctuations are seen to be much larger than statistically determined errors, revealing the presence of turbulence in the space flow, i.e gravitational waves. Bottom: South celestial pole region. The dot (red) at RA = 4.3^h, Dec = 75°S, and with speed 486 km/s, is the direction of motion of the solar system through space determined from NASA spacecraft earth-flyby Doppler shifts [1], revealing the EM radiation speed anisotropy. The thick (blue) circle centred on this direction is the observed velocity direction for different days of the year, caused by earth orbital motion and sun 3-space inflow. The corresponding results from the Miller gas-mode interferometer are shown by 2nd dot (red) and its aberration circle (red dots). For December 8, 1992, the velocity is RA = 5.2^h, Dec = 80°S, speed 491 km/s, see Table 2 of [1]. The thinner blue aberration circles relate to determination of earth 3-space inflow speed, see [1].

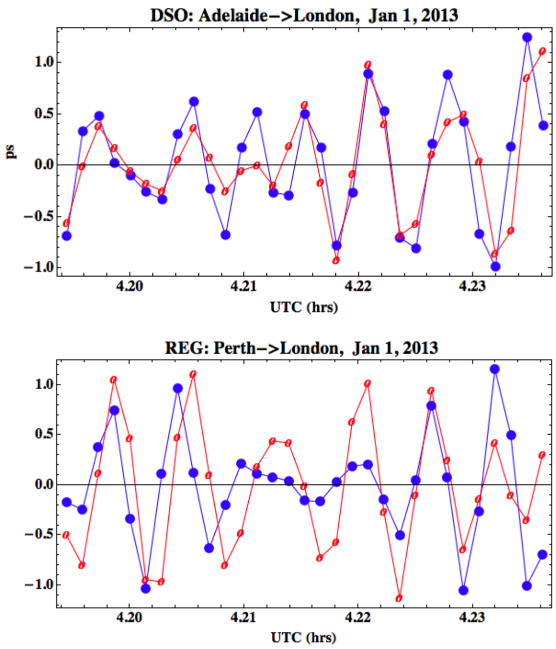

Fig. 2: Correlations in band-passed Adelaide-London DSO data (top) and Perth (Australia)-London REG data (bottom), for January 1, 2013, with London data (red, open dots) advanced by 15 s in both cases, over the same 200 s time interval. The data points are at 5 s intervals. In-phase correlations from collocated Zener Diode Detectors are shown in Fig. 7. The REG data was recorded every 1 s, and has been averaged to 5 s intervals for ease of comparison with DSO data. The data shows a quasi-periodicity of ∼20 s, related to the reverberation effect [3]. The UTC time at all detectors was determined using internet timing applications, which have ms precision.

short leads. This was intended to determine the S/N ratio for the joint Adelaide-London experiment. Surprisingly the internal noise was found to be correlated, with the noise in the London DSO being some 13 to 20 seconds behind the Adelaide DSO* noise, see Fig. 2. The correlation data had a phase that tracked sidereal time, meaning that the average direction was approximately fixed wrt the galaxy, but with extensive fluctuations as well from the gravitational wave/turbulence effect, that had been seen in all previous experiments. The explanation for this DSO effect was not possible as the DSO is a complex instruments, and which component was responding to the passing space fluctuations could not be determined. But the correlation analysis did demonstrate that not all of the internal noise in the DSO was being caused solely by some random process intrinsic to the instrument. Subsequent experiments, below, now suggest that there are zener diodes within the time difference measurements hardware within the DSO.

The travel time delay $\tau(t)$ was determined by computing the correlation function

$$C(\tau, t) = \int_{t-T}^{t+T} dt' S_1(t' - \tau/2) S_2[t' + \tau/2) e^{-a(t'-t)^2} \quad (2)$$

for the two detector signals $S_1(t)$ and $S_2(t)$. Here $2T = 200s$ is the time interval used, about UTC time t. The gaussian term ensures the absence of end-effects. Maximising $C(\tau, t)$ wrt τ gives $\tau(t)$ - the delay time vs UTC t, and plotted in Figs. 3 and 4, where the data has been binned into 1hr time intervals, and the rms also shown. The speed and direction, over a 24hr period, was determined by fitting the time delay data using

$$\tau = \frac{\mathbf{R} \cdot \mathbf{v}}{\mathbf{v}^2}, \quad (3)$$

where $\mathbf{R}$ is the Adelaide-London spatial separation vector, and $\mathbf{v}(\theta, \delta)$ is the 3-space velocity vector, parametrised by a speed, RA and Declination. This expression assumes a plane wave form for the gravitational waves. The $\tau(t)$ delay times show large fluctuations, corresponding to fluctuations in speed and/or direction, as also seen in data in Fig. 1, and also a quasi-periodicity, as seen in Fig. 2. Then only minimal travel times, 10 s $< \tau <$ 22 s, were retained. Correlations, as shown in Fig. 2, are not always evident, and then the correlation function $C(\tau, t)$ has a low value. Only $\tau(t)$ data from high values of the correlation function were used. The absence of correlations at all times is expected as the London detector is not directly "downstream" of the Adelaide detector, and so a fractal structure to space, possessing a spatial inhomogeneity, bars continuous correlations, and as well the wave structure will evolve during the travel time. Fig. 2 shows examples of significant correlations in phase and amplitude between all four detectors, but with some mismatches. The approximate travel time of 15 s in Fig. 2 at ∼4.2 hrs UTC is also apparent in Fig. 3, with the top figure showing the discovery of the correlations from the two DSO separated by a distance $R \approx 12160$ km. That the internal "noise" in these DSO is correlated is a major discovery.

There are much simpler devices that were discovered to also display time delayed correlations over large distances: these are the Random Number Generators (RNG) or Random Event Generators (REG). There are various designs available from manufacturers, and all claim that these devices manifest hardware random quantum processes, as they involve the quantum to classical transition when a measurements, say, of the quantum tunnelling of electrons through a nanotechnology potential barrier, ∼10 nm thickness, is measured by a classical/macroscopic system. According to the standard interpretation of the quantum theory, the collapse of the electron wave function to one side or the other of the barrier, after the tunnelling produces a component on each side, is purely a random event, internal to the quantum system. However this interpretation had never been tested experimentally. Guided by the results from the DSO correlated-noise effect, the data

*LeCroy WaveRunner 6051A DSOs were used.

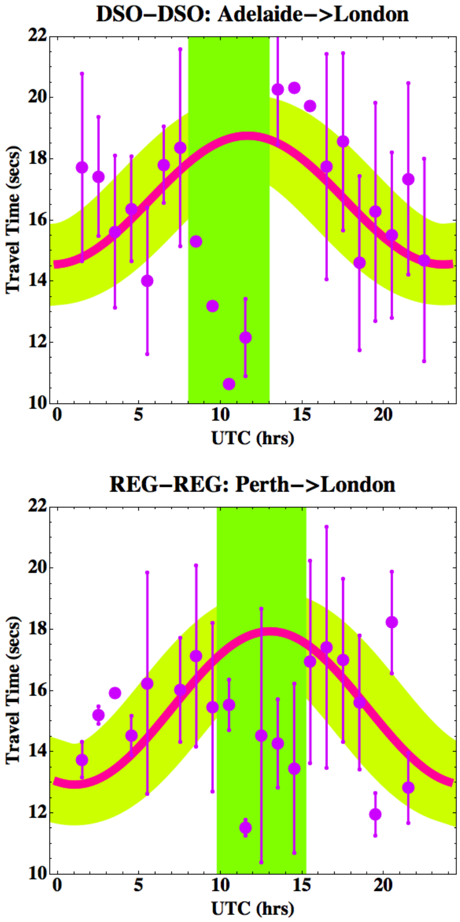

Fig. 3: Travel times from DSO-DSO Adelaide-London data (top), and REG-REG Perth-London data (bottom) from correlation analysis using (2). The data in each 1 hr interval has been binned, and the average and rms shown. The thick (red line) shows best fit to data using plane wave travel time predictor, (3), but after excluding those data points between 8 and 13 hrs UTC (top) and 10 and 15 hrs UTC (bottom), indicated by vertical band. Those data points are not consistent with the plane wave modelling, and suggest a scattering process when the waves pass deeper into the earth, see Fig. 5. The Perth-London phase is retarded wrt Adelaide-London phase by ~1.5 hrs, consistent with Perth being 1.5 hrs west of Adelaide. The Adelaide-London data gives speed = 512 km/s, RA = 4.8 hrs, Dec = 83°S, and the Perth-London data gives speed = 528 km/s, RA = 5.3 hrs, Dec = 81°S. The broad band tracking the best fit line is for ±1 sec fluctuations, corresponding to speed fluctuation of ±17 km/s. Actual fluctuations are larger than this, as 1st observed by Michelson-Morley and by Miller, see Fig. 1.

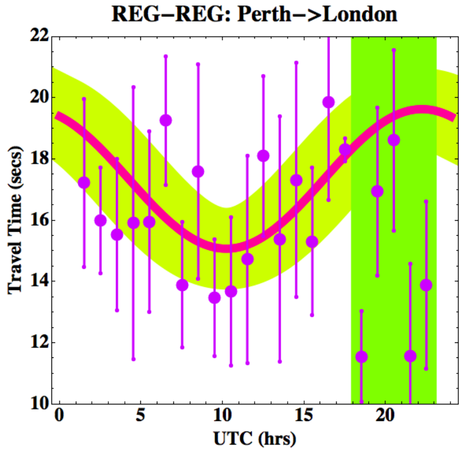

Fig. 4: Travel times from REG-REG Perth-London data for August 1, 2012. The data in each 1 hr interval has been binned, and the average and rms shown. The thick (red line) shows best fit to data using plane wave travel time predictor, (3), but after excluding those data points between 18 and 23 hrs UTC, indicated by vertical band. Those data points are not consistent with the plane wave modelling. This data gives speed = 471 km/s, RA = 4.4 hrs, Dec = 82°S. The change in phase of the maximum of the data, from UTC = 22±2 hr, for August 1, 2012, to UTC = 12±2 hr for January 2013 (Fig. 3), but with essentially the same RA, illustrates the sidereal effect: the average direction of the space flow is fixed wrt to the stars, apart from the earth-orbit aberration effect, Fig. 1.

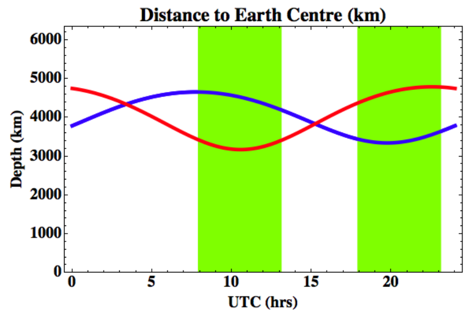

Fig. 5: Given measured space velocity, plots show maximum earth penetration depth of space detected by London detectors for Adelaide→London, Jan1, 2013 (red) and Perth→London, August 1, 2012 (blue), revealing that the anomalous scattering occurs when deeper depths are "traversed". The vertical shadings correspond to those in Fig. 3 (top) and Fig. 4.

from two REGs, located in Perth and London, was examined. The data[*] showed the same correlation effect as observed in the DSO experiments, see Figs. 2–4. However REGs typically employ a XOR gate that produces integer valued outputs with a predetermined statistical form. To study the zener diode tunnelling currents without XOR gate intervention two collocated zener diode circuits were used to detect highly correlated tunnelling currents, Figs. 6 and 7. When the detectors are separated by ~0.5 m, phase differences ~μs were observed and dependent on relative orientation. So this zener diode circuit forms a very simple and cheap nanotechnology quantum detector for gravitational waves.

[*]The data is from the GCP international network: `http://teilhard.global-mind.org/`

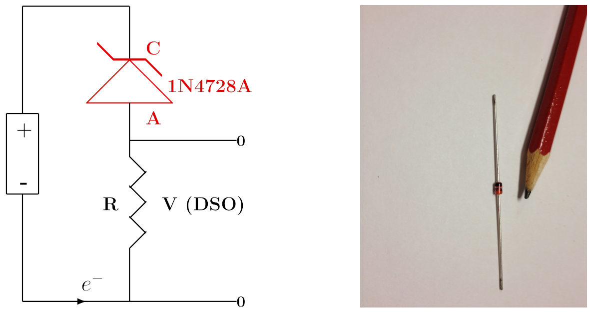

Fig. 6: Left: Circuit of Zener Diode Gravitational Wave Detector, showing 1.5 V AA battery, 1N4728A zener diode operating in reverse bias mode, and having a Zener voltage of 3.3 V, and resistor R = 10 kΩ. Voltage V across resistor is measured and used to determine the space driven fluctuating tunnelling current through the zener diode. Correlated currents from two collocated detectors are shown in Fig. 7. This design avoids data degradation from the XOR gate in commercial REGs. Right: Photo of zener diode showing size in comparison to pencil tip. The zener diode costs $0.5.

4 Dynamical 3-space gravitational waves

It is necessary to give some background to the interpretation of reported correlations as gravitational waves. Experiments and theory have suggested that space is a dynamical system:

$$\nabla\cdot\left(\frac{\partial \mathbf{v}}{\partial t}+(\mathbf{v}\cdot\nabla)\mathbf{v}\right)+\frac{5\alpha}{4}\left((trD)^2-tr(D^2)\right)+ \delta^2\nabla^2\left((trD)^2-tr(D^2)\right)+\ldots=-4\pi G\rho, \qquad (4)$$

where $D_{ij} = \partial v_i/\partial x_j$ and $\rho(\mathbf{r},\mathbf{t})$ is the usual matter density. This entails a velocity field $\mathbf{v}(\mathbf{r},t)$ describing the motion of a structured 3-space relative to an observers frame of reference. This easily follows from writing Newtonian gravity in terms of a velocity field, which then permits additional terms, with coefficients α and δ. This field and its fluctuations has been repeatedly detected over some 125 years. The 1st term, the Newtonian gravity term, involves the Euler 3-space constituent acceleration, while the $\alpha-$ and $\delta-$ terms contain higher order derivative terms and describe the self interaction of space. Laboratory, geophysical and astronomical data suggest that α is the fine structure constant $\approx 1/137$, while δ appears to be a very small but non-zero Planck-like length. The emergence of gravity arises from the unique coupling of quantum theory to the 3-space, which determines the 'gravitational' acceleration of quantum matter as a quantum wave refraction effect,

$$\mathbf{g}=\frac{\partial \mathbf{v}}{\partial t}+(\mathbf{v}\cdot\nabla)\mathbf{v}+(\nabla\times\mathbf{v})\mathbf{v_R}-\frac{\mathbf{v_R}}{1-\frac{\mathbf{v_R^2}}{\mathbf{c^2}}}\frac{\mathbf{1}}{\mathbf{2}}\frac{\mathbf{d}}{\mathbf{dt}}\left(\frac{\mathbf{v_R^2}}{\mathbf{c^2}}\right) \qquad (5)$$

where $\mathbf{v_R} = \mathbf{v_0} - \mathbf{v}$ is the velocity of quantum matter relative to the local space. The 1st two terms are the Euler 3-space acceleration, the 2nd term explains the Lense-Thirring effect when the vorticity is non-zero, and the last term explains the precession of planetary orbits. Neglecting relativistic effects (4) and (5) give

$$\nabla\cdot\mathbf{g} = -4\pi\mathbf{G}\rho - 4\pi\mathbf{G}\rho_{\mathbf{DM}}, \qquad (6)$$

where ρ_{DM} is the α and δ term, describing a 3-space self-interaction effects, with the α term explaining the so-called 'dark matter' effects. The spatial dynamics is non-local and exhibits instantaneous effects, which points to the universe being highly connected, consistent with the deeper pre-space *Process Physics* [6]. Historically this was first noticed by Newton who called it action-at-a-distance. This shows a high degree of non-locality and non-linearity, and in particular that the behaviour of both ρ_{DM} and ρ manifest at a distance irrespective of the dynamics of the intervening space. A key implication of (6) is that observed fluctuations in $\mathbf{v}(\mathbf{r},t)$ can only generate gravitational effects via the ρ_{DM} processes. So the velocity field is more fundamental than the Newtonian gravitational acceleration field. Although not presented herein significant fluctuations in $\mathbf{v}(\mathbf{r},t)$ were observed to be correlated with solar flares, coronal mass ejections, and earthquakes. These effects suggest that the 11 year solar cycle is caused by galactic-scale larger than normal 3-space fluctuations. The delay of several days between major fluctuations and solar flares implies that the new 3-space/gravitational wave detectors may be used as an early warning system for such solar flares.

One consequence of the non-linearity of (4) is that fluctuations in $\mathbf{v}(\mathbf{r},t)$ develop reverberations [3], which are clearly apparent in the data in Fig. 2. Another implication suggested by the data is that when the 3-space fluctuations penetrate the earth the non-linearity cause the 3-space waveforms to manifest at a distance, without propagating through the intervening space, resulting in an apparent speed-up, as manifestly evident in the data – an effect that had to be taken into account in the analysis based upon a normal plane-wave like propagation, as indicated by the vertical bands in Figs. 3 and 4. The data from numerous experiments clearly shows that the so-called "gravitational waves" have observed properties very different from those commonly assumed.

5 Probability in Quantum Theory

The conventional quantum theories all have the generic form $i\hbar\partial\psi/\partial t = H\psi$, differing only by the configuration space on which ψ is based, and the Hamiltonian. The interpretation has been, as proposed by Born, that $|\psi|^2$ is the probability density for the location of a particle, which is assumed to exist apart from ψ. However missing from this generic unitary time evolution for ψ is (i) the existence of a dynamical 3-space, as distinct from the usual frame of reference, and which leads to gravity as am emergent phenomenon, and (ii) the existence of terms which model the localisation of ψ in space by a classical detector of quantum waves [5]. In [6, p. 40], it was

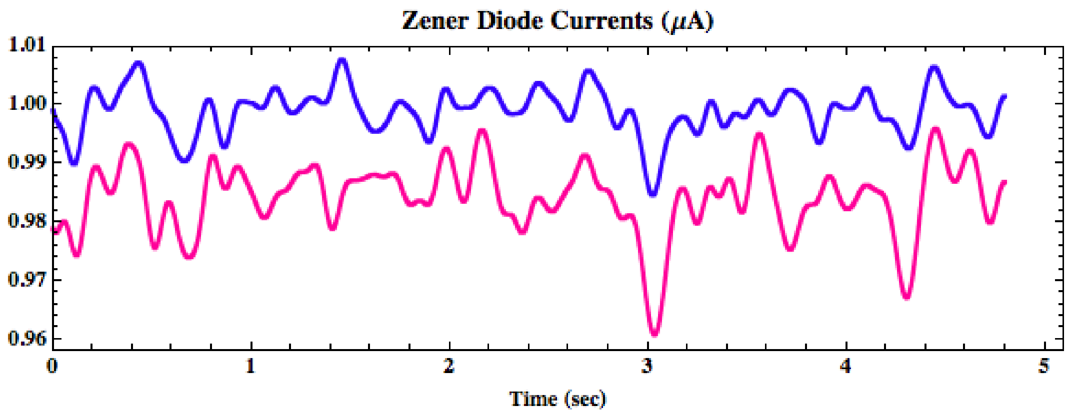

Fig. 7: Zener Diode tunnelling currents over 5 sec interval, showing higher time resolution than in Fig. 2. Band pass filter was used to remove higher frequencies. Plots have been displaced vertically for ease of viewing. The two zener diode circuits were collocated with the zener diodes separated by ~30 mm. Highly correlated currents are observed, demonstrating that the tunnelling currents are not random, as required by the conventional interpretation of quantum theory, and as 1st discovered in the Adelaide-London correlations.

argued that emergent classicality, including the ψ localisation effects, are caused by fluctuations in the 3-space. This and the present results would amount to the discovery that reality is fundamentally only quantum waves embedded in a quantum foam space, and that the classical world is an emergent macroscopic phenomenon: our reality is induced by the nature of 3-space fluctuations.

6 Conclusions

We have reported the discovery of the quantum detection of gravitational waves, showing correlations between well separated locations, that permitted the absolute determination of the 3-space velocity of some 500 km/s, in agreement with the speed and direction from a number of previous analyses, including in particular the NASA spacecraft earth-flyby Doppler shift effect. This discovery enables a very simple and cheap nanotechnology zener diode quantum gravitational wave detection technology, which will permit the study of various associated phenomena, such as solar flares, coronal mass ejections, earthquakes, eclipse effects, moon location effects, non-Poisson fluctuations in radioactivity [4], and other rate processes, and variations in radioactive decay rates related to distance of the earth from the Sun, as the 3-space fluctuations are enhanced by proximity to the sun.

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`http://teilhard.global-mind.org/`
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