Quantum Gravity Experiments: No Magnetic Effects

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A quantum gravity experiment was reported in Cahill, *Progress in Physics*, 2015, v.11(4), 317-320, with the data confirming the generalisation of the Schrödinger equation to include the interaction of the wave function with dynamical space. Dynamical space, via this interaction process, raises and lowers the energy of the electron wave function, which is detected by observing consequent variations in the electron quantum barrier tunnelling rate in reverse-biased Zener diodes. This process has previously been reported and enabled the measurement of the speed of the dynamical space flow, which is consistent with numerous other detection experiments. However Vrba, *Progress in Physics*, 2015, v.11(4), 330, has suggested the various experimental results may have been caused by magnetic field effects, but without any experimental evidence. Here we show experimentally that there is no such magnetic field effect in the Zener Diode Dynamical Space Quantum Detectors.

1 Introduction

In [1] a quantum theory of gravity [2] was directly experimentally tested. This theory explains the gravitational acceleration of matter as caused by the refraction of quantum waves by the time dependence and spatial inhomogeneities of the dynamical space flow.* This has been successfully tested against numerous experimental gravitational phenomena [3]. More recently quantum detectors have been developed that directly detected the space flow [5,6]. All these different experimental techniques reveal a turbulent space flow speed from direction RA $\sim 4.5hrs$, Dec $\sim 80°$S, with a speed of ~ 500km/s, with a $1/f$ fractal structure.

The dynamical space quantum detectors use reverse biased Zener Diodes, Fig.1. In [1] a new critical experimental test of this quantum theory of gravity, was reported, namely an orientation dependent effect, which directly tests the modified Schrödinger equation [2], which includes the effects of the dynamical space.

However Vrba [7] has suggested that the various effects reported [1, 5, 6] with the quantum detectors could have been caused by magnetic effects, but without any experimental data to test that conjecture. Here we report a variation of the quantum detectors that demonstrates experimentally the absence of any magnetic induction effects, and thus refuting the conjecture in [7].

2 Quantum Gravity Experiment

Dynamical space is a phenomenon repeatedly detected by a variety of experimental techniques [3], such as light speed
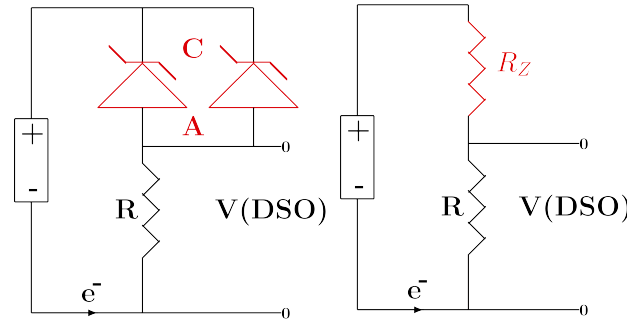

Fig. 1: Left: Circuit of Zener Diode Space Flow Detector, showing 1.5V AA battery, 2 1N4728A Zener diodes in parallel (actual detectors use 5 diodes) operating in reverse bias mode, and having a Zener voltage of 3.3V, and resistor R=10KΩ. Voltage V across resistor R is measured by Digital Storage Oscilloscope (DSO) and used to determine the turbulent space flow driven fluctuating quantum tunnelling current through the Zener diodes. Right: Detector with 5 Zener Diodes replaced by equivalent resistor $R_Z = 20K\Omega$. Currents from two collocated detectors are shown in Fig.2.

anisotropy detected by gas-mode Michelson interferometers, EM speed anisotropy in RF coaxial cables and Doppler shifts from spacecraft Earth-flyby [4]. Light speed anisotropy requires that Maxwell's EM equations be modified by the replacement of the Euler time derivative:

$$\partial/\partial t \rightarrow \partial/\partial t + \mathbf{v}(\mathbf{r}, t) \cdot \nabla$$

where $\mathbf{v}(\mathbf{r}, t)$ is the classical field description of the dynamical space velocity, at location and time used by the observer. When using the appropriate and detected space flow velocity for the Sun this results in the observed bending of star light by the Sun. The Schrödinger equation must also be extended

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*This approach is different from the conjectured path to quantum gravity which assumed that this would arise from a quantisation procedure of a classical theory of gravity. This approach has never been successfully implemented. The Quantum Gravity reported in [1, 2] is emergent, and not from such a quantisation procedure.

by using the Euler time derivative [2]:

$$i\hbar\frac{\partial \psi(\mathbf{r}, t)}{\partial t} = -\frac{\hbar^2}{2m}\nabla^2\psi(\mathbf{r}, t) + V(\mathbf{r}, t)\psi(\mathbf{r}, t) - i\hbar\mathbf{v}(\mathbf{r}, t)\cdot\nabla\psi(\mathbf{r}, \mathbf{t})$$

$$(1)$$

An analogous extension is also necessary in the Dirac equation [8]. The presence of the $-i\hbar\mathbf{v}\cdot\nabla$ dynamical space term provides a critical test of the emergent quantum gravity theory. For plane wave electrons, $\psi \sim e^{(i\mathbf{k}\cdot\mathbf{r}-i\omega t)}$, the space interaction term changes the energy of the electrons quantum tunnelling through the Zener Diode quantum barrier, for uniform $\mathbf{v}$:

$$E = \hbar\omega \rightarrow \hbar\omega + \hbar\mathbf{k} \cdot \mathbf{v} \qquad (2)$$

This space flow induced energy shift changes the potential energy barrier electron quantum tunnelling amplitudes in a reverse-biased Zener diode. This effect is easily measured by means of the circuit in LHS Fig.1. A critical implication is that the electron tunnelling current must depend on the angle θ between $\mathbf{k}$ and $\mathbf{v}$, as in in $\mathbf{k}\cdot\mathbf{v} = kv\cos(\theta)$, as experimentally demonstrated in [1]. Here we show that the observed current fluctuations significantly occur only when the Zener diodes are present, as in Fig.2, Top. In Fig.2, Bottom, we show that current fluctuations when the diodes in one of the detectors are replaced by a resister R_Z, whose value matches the average reverse-biased diodes resistance. The data shows that the current fluctuations are now considerably reduced, and are Johnson noise [1] in the resistor R_Z, and approximately correlated with the collocated Zener diode detector current fluctuations. Were magnetic field inductions responsible, then the current fluctuations, with resistor R_Z present, in Fig.2, Bottom, would have been essentially the same magnitude or even larger, as now there are no Zener diodes to limit the current flow.

3 Conclusions

The experimental results herein demonstrate that the conjecture [7] that the effects reported in [1, 5, 6] are merely the consequences of a magnetic field induction process is disproven. That effect predicts that the two current fluctuations in Fig.2, Bottom, should have been essentially the same, and this is not experimentally seen. The fundamental results following from these experiments, and agreeing with other experimental data [3, 9] using a variety of experimental techniques, demonstrates that we have a unification of quantum phenomena and gravitational phenomena, and that space is an observable dynamical system, with gravity an emergent quantum effect arising from the refraction of quantum matter waves by inhomogeneities of the observed space flow.
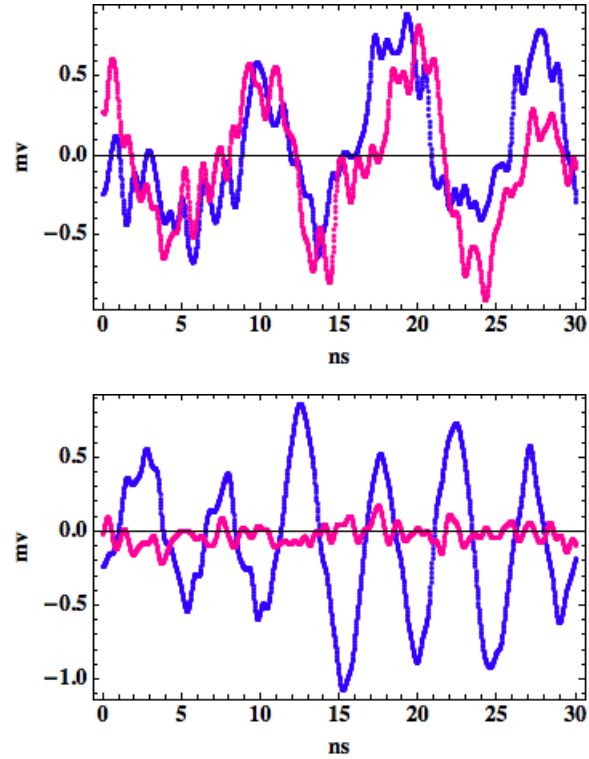

Fig. 2: Current fluctuations, as indicated by voltage across resistor R, and with DSO operated with $1M\Omega$ AC input, and no filters. Top: Correlated current fluctuations from two collocated parallel detectors, as shown in Fig.1, [1], using circuit on LHS of Fig.1. Bottom: From two collocated parallel detectors, but using for one detector the circuit on RHS of Fig.1, with Zener diodes replaced by equivalent resister $R_Z = 20K\Omega$. The resistor circuit only produces the weaker signal, which is approximately correlated with the Zener Diode current fluctuations, and is Space-flow induced Johnson Noise [1] in the resistors R_Z. This comparison demonstrates that the data reported in [1] arises from quantum tunnelling effects in the Zener Diodes, and not from any magnetic induction effects.

References

[1] Cahill R.T. Quantum Gravity Experiments, *Progress in Physics*, 2015, v.11(4), 317-320.

[2] Cahill R.T. Dynamical Fractal 3-Space and the Generalised Schrödinger Equation: Equivalence Principle and Vorticity Effects, *Progress in Physics*, 2006, v.1, 27-34.

[3] Cahill R.T. Discovery of Dynamical 3-Space: Theory, Experiments and Observations - A Review, *American Journal of Space Science*, 2013, v.1(2), 77-93.

[4] Cahill R.T. Combining NASA/JPL One-Way Optical-Fiber Light Speed Data with Spacecraft Earth-Flyby Doppler-Shift Data to Characterise 3-Space Flow, *Progress in Physics*, 2009, 4, 50-64.

[5] Cahill R.T. Nanotechnology Quantum Detectors for Gravitational Waves: Adelaide to London Correlations Observed, *Progress in Physics*, 2013, v.4, 57-62.

[6] Cahill R.T. Gravitational Wave Experiments with Zener Diode Quantum Detectors: Fractal Dynamical Space and Universe Expansion with Inflation Epoch, *Progress in Physics*, 2014, v.10(3), 131-138.

[7] Vrba A.L. Reservations on Cahill's Quantum Gravity Experiment, *Progress in Physics*, 2015, v.11(4), 330.

[8] Cahill R.T. Dynamical 3-Space: neo-Lorentz Relativity, *Physics International*, 2013, v4(1), 60-72.

[9] Cahill R.T. Review of Gravitational Wave Detections: Dynamical Space, *Physics International*, 2014, 5(1), 49-86.