Solar Flare Five-Day Predictions from Quantum Detectors of Dynamical Space Fractal Flow Turbulence: Gravitational Wave Diminution and Earth Climate Cooling

Reginald T. Cahill

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

Space speed fluctuations, which have a 1/f spectrum, are shown to be the cause of solar flares. The direction and magnitude of the space flow has been detected from numerous different experimental techniques, and is close to the normal to the plane of the ecliptic. Zener diode data shows that the fluctuations in the space speed closely match the Sun Solar Cycle 23 flare count, and reveal that major solar flares follow major space speed fluctuations by some 6 days. This implies that a warning period of some 5 days in predicting major solar flares is possible using such detectors. This has significant consequences in being able to protect various spacecraft and Earth located electrical systems from the subsequent arrival of ejected plasma from a solar flare. These space speed fluctuations are the actual gravitational waves, and have a significant magnitude. This discovery is a significant application of the dynamical space phenomenon and theory. We also show that space flow turbulence impacts on the Earth's climate, as such turbulence can input energy into systems, which is the basis of the Zener Diode Quantum Detector. Large scale space fluctuations impact on both the sun and the Earth, and as well explain temperature correlations with solar activity, but that the Earth temperatures are not caused by such solar activity. This implies that the Earth climate debate has been missing a key physical process. Observed diminishing gravitational waves imply a cooling epoch for the Earth for the next 30 years.

1 Introduction

We report evidence that space flow turbulence causes solar flares, and that very simple Zener Diode Quantum Detectors, ZDQD, may be easily used to measure and characterise this turbulence. As well the major space flow turbulence precedes the solar flare eruptions by some 6 days, making it possible to have an early warning system in operation so as to limit damage to spacecraft electronics, power system networks, and other electronic infrastructure systems, when the resulting plasma reaches Earth. We demonstrate these developments by two methods: 1st by showing that the current fluctuations from ZDQD over the last Solar Cycle 23 track very accurately the Solar Flare count rate, see Fig. 1. Those correlations do not establish any causal relation. However in Fig. 6 we establish that significant space speed fluctuations cause the solar flares, as the flares are delayed by some 6 days. The solar flare data is of the Halloween Space Weather Storm of 2003, while the ZDQD data is from a GCP detector*.

---

*The GCP network is a worldwide collection of Zener Diode detectors that report space fluctuations every 1 sec. However it was not set up for that purpose, and was incorrectly based on the belief that quantum fluctuations are truly random and intrinsic to each quantum system, see http://noosphere.princeton.edu/. The GCP network was then being used to suggest that correlations in the network data were not caused by any physical process, but by collective human "consciousness". This has been shown to be false, as the correlated fluctuations have been shown to be caused by flowing space turbulence [1–3].

2 Dynamical space

The dynamics and detection of space is a phenomenon that physics missed from its beginning, with space modelled as a geometric entity without structure or time dependence. That has changed recently with the determination of the speed and direction of the solar system through the dynamical space, and the characterisation of the flow turbulence: gravitational waves. Detections used various techniques have all produced the same speed and direction Cahill [1–6]. The detected dynamical space was missing from all conventional theories in physics: Gravity, Electromagnetism, Atomic, Nuclear, Climate,... The detection of the dynamical space has led to a major new and extensively tested theory of reality, and goes under the general name of Process Physics [7]. Here we cite only those aspects relevant to Solar Flares and Climate Change.

The Schrödinger equation extension to include the dynamical space is [8]

$$i\hbar\frac{\partial\psi(\mathbf{r},t)}{\partial t} = -\frac{\hbar^2}{2m}\nabla^2\psi(\mathbf{r},t) + V(\mathbf{r},t)\psi(\mathbf{r},t) +$$
$$-i\hbar\left(\mathbf{v}(\mathbf{r},t)\cdot\nabla + \frac{1}{2}\nabla\cdot\mathbf{v}(\mathbf{r},t)\right)\psi(\mathbf{r},t). \qquad (1)$$

Here $\mathbf{v}(\mathbf{r},t)$ is the velocity field describing the dynamical space at a classical field level, and the coordinates $\mathbf{r}$ give the relative location of $\psi(\mathbf{r},t)$ and $\mathbf{v}(\mathbf{r},t)$, relative to a Euclidean embedding space, and also used by an observer to
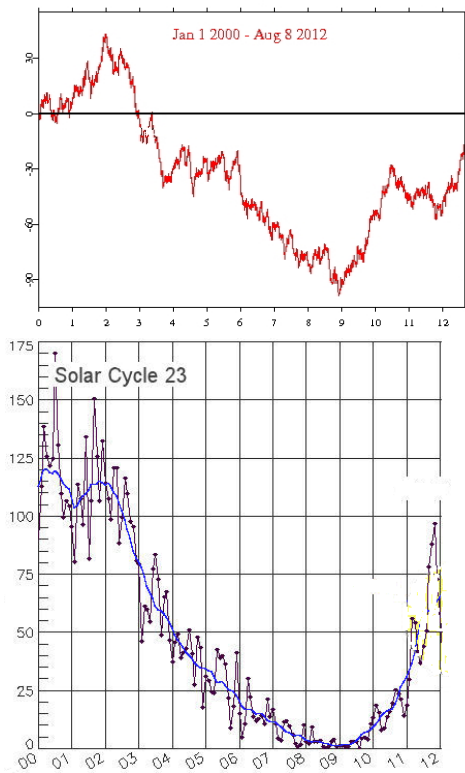
Fig. 1: Top: Measure of Zener diode GCP network current fluctuations over Solar Cycle 23, beginning with zero on January 1, 2000, adapted from R. Nelson, *Long Term Cumulative Deviation of Network Variance:* http://noosphere.princeton.edu/longterm.html. Bottom: Sunspot numbers for the same time period, adapted from T. Phillips, http://science.nasa.gov/media/medialibrary/2013/03/01/ shortfall.jpg. We see the close correlation between these two phenomena. A causal relationship between space speed fluctuations and sunspots is demonstrated in Fig. 6: space flow fluctuations/turbulence precede by some 6 days the solar flares, implying that it is the space flow turbulence that causes the solar flares. This data shows the weakening of the solar cycle as being caused by weakening of the space flow turbulence. The data in Fig. 8 shows sea temperature history tracking solar flares, but not caused by the solar flares. There is a fundamental difference between correlations and cause and effect dynamics.

locate structures. At sufficiently small distance scales that embedding and the velocity description is conjectured to be not possible, as then the dynamical space requires an indeterminate dimension embedding space, being possibly a quantum foam [7]. This minimal generalisation of the original Schrödinger equation arises from the replacement $\partial/\partial t \rightarrow \partial/\partial t + \mathbf{v}.\nabla$, which ensures that the quantum system properties are determined by the dynamical space, and not by the embedding coordinate system. The same replacement is also to be implemented in the original Maxwell equations, yielding that the speed of light is constant only wrt the local dynamical space, as observed, and which results in lensing from stars
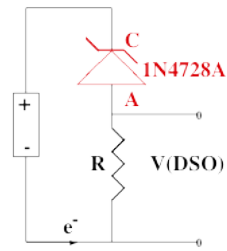

Fig. 2: Circuit of Zener Diode Gravitational Wave Detector, showing 1.5V AA battery, two 1N4728A Zener diodes operating in reverse bias mode, and having a Zener voltage of 3.3V, and resistor R= 10KΩ. Voltage V across resistor is measured and used to determine the space driven fluctuating tunnelling current through the Zener diodes. Current fluctuations from two collocated detectors are shown to be the same, but when spatially separated there is a time delay effect, so the current fluctuations are caused by space speed fluctuations [2,3]. Using diodes in parallel increases S/N. The data used herein is from a GCP detector that has a XOR gate that partially degrades the data.

and black holes. The extra $\nabla \cdot \mathbf{v}$ term in (1) is required to make the hamiltonian in (1) hermitian. Essentially the existence of the dynamical space in all theories has been missing. The dynamical theory of space itself is briefly reviewed below. The dynamical space velocity has been detected with numerous techniques, dating back to the 1st detection, the Michelson-Morley experiment of 1887, which was misunderstood, and which lead to physics developing flawed theories of the various phenomena noted above. A particularly good technique used the NASA Doppler shifts from spacecraft Earth-flybys, [6], to determine the anisotropy of the speed of EM waves, as indicated in Fig. 4. All successful detection techniques have observed significant fluctuations in speed and direction: these are the actually "gravitational waves", because they are associated with gravitational and other effects[*]

A significant effect follows from (1), namely the emergence of gravity as a quantum effect: a wave packet analysis shows that the acceleration of a wave packet, due to the space terms alone (when $V(\mathbf{r}, t) = 0$), given by $\mathbf{g} = d^2 \langle \mathbf{r} \rangle / dt^2$, [8], gives

$$g(\mathbf{r}, t) = \frac{\partial \mathbf{v}}{\partial t} + (\mathbf{v} \cdot \nabla)\mathbf{v}. \tag{2}$$

That derivation showed that the acceleration is independent of the mass m: whence we have the 1st derivation of the Weak Equivalence Principle, discovered experimentally by Galileo. As noted below the dynamical theory for $\mathbf{v}(\mathbf{r}, t)$ has explained numerous gravitational phenomena.

---

[*]Note that vacuum-mode Michelson interferometers, such as LIGO, cannot detect these wave effects. Only dielectric-mode versions have detected such waves, although there is a variety of other successful techniques [1,4]. In particular we report here the role of these waves in solar flare excitations and Earth climate science.
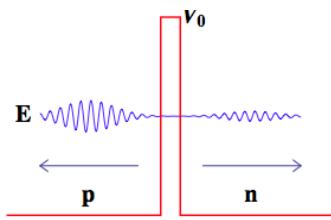
Fig. 3: Reflected (LHS) and transmitted (RHS) wave packets after interaction with barrier at a reverse-biased *pn* junction, as in Fig. 2. Energy E of wave packet is less than potential barrier height V_0. The wave function transmission varies with the speed $\mathbf{v}$ of the passing space as that varies $E \rightarrow E + \hbar \mathbf{k} \cdot \mathbf{v}$ according to (1) and so we may measure $\mathbf{v}$.
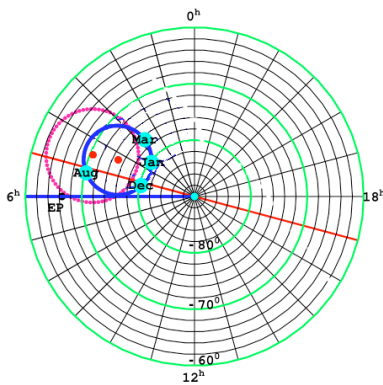

Fig. 4: South celestial pole region. The dot (red) at RA=4.3^h, Dec=75°S, and with speed 486km/s, is the direction of motion of the solar system through space determined from NASA spacecraft Earth-flyby Doppler shifts [6], as revealed by the EM radiation speed anisotropy. The thick (blue) circle centred on this direction is the observed velocity direction for different months of the year, caused by Earth orbital motion and sun 3-space inflow. The corresponding results from the 1925/26 Miller gas-mode interferometer are shown by 2nd dot (red) and its aberration circle (red dots). For December 8, 1992, the speed is 491km/s from direction RA=5.2^h, Dec=80°S, see Table 2 of [6]. EP is the pole direction of the plane of the ecliptic, and so the space flow is close to being perpendicular to the plane of the ecliptic.

3 Dynamical 3-space

The experimental data reveals the existence of a dynamical space. It is a simple matter to arrive at the dynamical theory of space, and the emergence of gravity as a quantum matter effect, as noted above. The key insight is to note that the emergent quantum-theoretic matter acceleration in (2), $\partial \mathbf{v}/\partial t + (\mathbf{v} \cdot \nabla)\mathbf{v}$, is also, and independently, the constituent Euler acceleration $\mathbf{a}(\mathbf{r}, t)$ of the space flow velocity field,

$$\mathbf{a}(\mathbf{r}, t) = \lim_{\Delta t \to 0} \frac{\mathbf{v}(\mathbf{r} + \mathbf{v}(\mathbf{r}, t)\Delta t, t + \Delta t) - \mathbf{v}(\mathbf{r}, t)}{\Delta t}$$

$$= \frac{\partial \mathbf{v}}{\partial t} + (\mathbf{v} \cdot \nabla)\mathbf{v} \qquad (3)$$
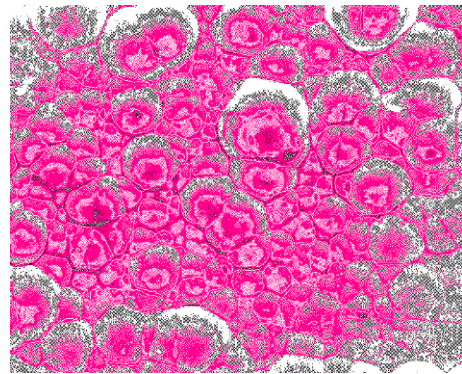

Fig. 5: Representation of the fractal wave data revealing the fractal textured structure of the 3-space, with cells of space having slightly different velocities and continually changing, and moving wrt the Earth with a speed of ~500 km/s, and in the directions indicated in Fig. 4, namely almost perpendicular to the plane of the ecliptic. This "red space" is suggestive of the 1/f spectrum of the detected fluctuations, see [5]. These space flow fluctuations inject energy into both the sun and the Earth. For solar flare effects low pass filtering of the data is necessary to isolate cells that overlap the Earth and sun, as in Fig .6.

which describes the acceleration of a constituent element of space by tracking its change in velocity. This means that space has a structure that permits its velocity to be defined and detected, which experimentally has been done. This then suggests, from (2) and (3), that the simplest dynamical equation for $\mathbf{v}(\mathbf{r}, t)$ is

$$\nabla \cdot \left(\frac{\partial \mathbf{v}}{\partial t} + (\mathbf{v} \cdot \nabla)\mathbf{v} \right) = -4\pi G \rho(\mathbf{r}, t); \quad \nabla \times \mathbf{v} = \mathbf{0} \qquad (4)$$

because it then gives $\nabla . \mathbf{g} = -4\pi G \rho(\mathbf{r}, t)$, $\nabla \times \mathbf{g} = \mathbf{0}$, which is Newton's inverse square law of gravity in differential form. Hence the fundamental insight is that Newton's gravitational acceleration field $\mathbf{g}(\mathbf{r}, t)$ for matter is really the acceleration field $\mathbf{a}(\mathbf{r}, t)$ of the structured dynamical space[*], and that quantum matter acquires that acceleration because it is fundamentally a wave effect, and the wave is refracted by the accelerations of space.

While the above leads to the simplest 3-space dynamical equation this derivation is not complete yet. One can add additional terms with the same order in speed spatial derivatives, and which cannot be *a priori* neglected. There are two such terms, as in

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

where $D_{ij} = \partial v_i / \partial x_j$. However to preserve the inverse square law external to a sphere of matter the two terms must have

---

[*]With vorticity $\nabla \times \mathbf{v} \neq \mathbf{0}$ and relativistic effects, the acceleration of matter becomes different from the acceleration of space [7].

coefficients α and $-\alpha$, as shown. Here α is a dimensionless space self-interaction coupling constant, which experimental data reveals to be, approximately, the fine structure constant, $\alpha = e^2/\hbar c$, [11]. The ellipsis denotes higher order derivative terms with dimensioned coupling constants, which come into play when the flow speed changes rapidly wrt distance. The observed dynamics of stars and gas clouds near the centre of the Milky Way galaxy has revealed the need for such a term [9], and we find that the space dynamics then requires an extra term:

$$\nabla \cdot \left(\frac{\partial \mathbf{v}}{\partial t} + (\mathbf{v} \cdot \nabla)\mathbf{v} \right) + \frac{5\alpha}{4} \left((trD)^2 - tr(D^2) \right) +$$

$$+ \delta^2 \nabla^2 \left((trD)^2 - tr(D^2) \right) + ... = -4\pi G\rho \qquad (6)$$

where δ has the dimensions of length, and appears to be a very small Planck-like length [9]. This then gives us the dynamical theory of 3-space. It can be thought of as arising via a derivative expansion from a deeper theory, such as a quantum foam theory, [7]. Note that the equation does not involve c, is non-linear and time-dependent, and involves non-local direct interactions. Its success implies that the universe is more connected than previously thought. Even in the absence of matter there can be time-dependent flows of space.

Note that the dynamical space equation, apart from the short distance effect - the δ term, there is no scale factor, and hence a scale free structure to space is to be expected, namely a fractal space. That dynamical equation has back hole and cosmic filament solutions [9, 11], which are non-singular because of the effect of the δ term. At large distance scales it appears that a homogeneous space is dynamically unstable and undergoes dynamical breakdown of symmetry to form a spatial network of black holes and filaments, [11], to which matter is attracted and coalesces into gas clouds, stars and galaxies.

The dynamical space equation (6) explains phenomena such as Earth bore-hole gravity anomalies, from which the value of α was extracted, flat rotation curves for spiral galaxies, galactic black holes and cosmic filaments, the universe growing/expanding at almost a constant rate, weak and strong gravitational lensing of light,... [4, 9–11]. A significant aspect of the space dynamics is that space is not conserved: it is continually growing, giving the observed universe expansion, and is dissipated by matter. As well it has no energy density measure. Nevertheless it can generate energy into matter.

4   Detecting dynamical space speed and turbulence with diodes

The Zener diode in reverse bias mode can easily and reliably measure the space speed fluctuations, Fig. 2, and two such detectors can measure the speed and direction of the space flow and waves, Cahill [1–4]. Consider plane waves with energy $E = \hbar\omega$. Then (1) with $v = 0$ and $V = 0$ gives $\psi = e^{-\omega t + i\mathbf{k} \cdot \mathbf{r}}$.

When $v \neq 0$, but locally uniform wrt to the diode, the energy becomes $E \rightarrow E + \hbar \mathbf{k} \cdot \mathbf{v}$. This energy shift can be easily detected by the diode as the electron transmission current increases with increased energy*. By using spatially separated diodes the speed and direction has been measured [1–4], and agrees with other detection techniques.

Although this Zener diode effect was only discovered in 2013, [3], Zener diode detectors have been available commercially for much longer, and are known as Random Event Generators, (REG). That terminology was based on the flawed assumption that the quantum tunnelling fluctuations were random wrt an average. However the data in [3] 1st showed that this is not the case. That experimental result contradicts the standard interpretation of "randomness" in quantum processes, which dates back to the Born interpretation in 1926. To the contrary the recent experiments show that the fluctuations are not random, but are directly determined by the fluctuations in the passing dynamical space.

5   Gravitational waves and solar flares

Fig. 1 shows the strong correlation between gravitational wave turbulence, as detected by the Earth-based ZDQD network, and the count rate of solar flares. At very low frequencies we can determine correlations based upon large "cells" of space, Fig. 5, passing almost perpendicular to the plane of the ecliptic. One key discovery herein is that the large space flow turbulences are the cause of significant solar flares, as shown in Fig. 6, top plot. That shows that the pattern of solar flares during the Halloween Space Weather Storms of 2003 closely match the pattern of 6-day-delayed space turbulence. Hence by using low-pass filtered data from Earth based ZDQD it is possible to predict with some 5 day warning the occurrence of major solar flares. This effect reveals the the space turbulence generates energetic activity in the sun, which eventually reaches the surface. However Fig. 6, bottom plot, suggests that the same mechanism is not relevant to Coronal Mass Ejections, although the data reported herein is limited to only one case.

6   Space flow turbulence and earth weather

There have been many studies noting correlations between solar cycles and changes in the Earth Weather, see [13] for review and references. The most notable being the Maunder minimum 1645-1715, during which there was no sunspot activity, and which coincided with the "little ice age". However correlations do not provide causal relations. The assumption has always been that increased sunspot activity results in increased solar irradiance which subsequently causes increased Earth temperatures, although no convincing mechanism has

---

*The Zener diode currents reported in [1–4] were incorrectly determined. The Digital Storage Oscilloscope (DSO)was operated with 50Ω input impedance, which meant the voltage was developed across that resistance and not the 10kΩ cited, and shown in Fig. 2. This means that the actual tunnelling currents were 200 times larger. This had no effect on the conclusions.
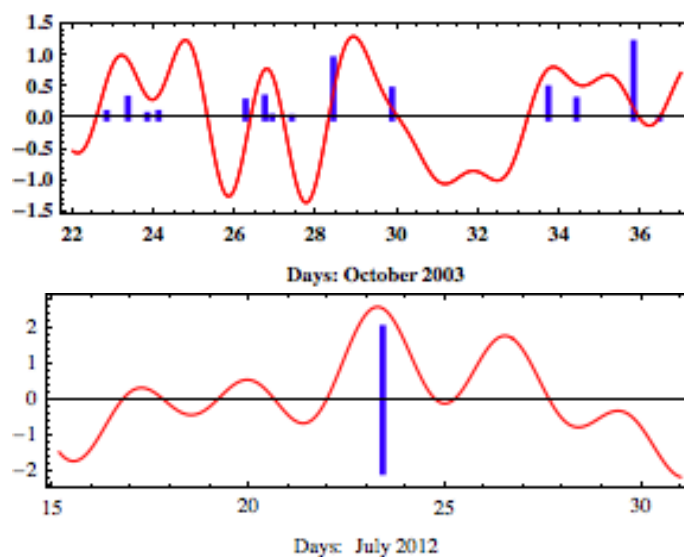
Fig. 6: Top: Vertical blue lines indicate start times of major solar flares beginning October 22, 2003. The height of the lines is indicative of the magnitude of the solar flare, and is on a logarithmic scale. These solar flares are known as the Halloween Space Weather Storms of 2003, [12]. The curve is data from a single ZDQD, located in Switzerland, low-pass filtered to include only periods longer than 2 days, and advanced in time by 6 days, and plotted relative to the average. For a space speed of 500 km/s this corresponds to a cell size ~0.5 of the Sun-Earth distance. This advance followed from matching the two data sets. The low-pass filter ensures that we see space fluctuations corresponding to cell sizes that can overlap the Earth and the sun, as the space flow is close to being perpendicular to the plane of the ecliptic, as shown by the analysis of the NASA Earth-flyby spacecraft Doppler shifts in Fig. 4, [6]. The strong correlation between the two data sets show that solar flares follow increases in the space velocity, by some 6 days: the solar flares are caused by the space fluctuations: these fluctuations are a galactic phenomenon. Bottom: Vertical blue line indicates start of massive Coronal Mass Ejection (CME) on July 23, 2012, and plotted with ZDQD low-pass data, but without time shift. The main speed fluctuation peak coincides with the CME, on July 23. This suggests that CME may not be caused by space fluctuations, and that the coincident peak may be gravitational waves produced by the extremely large mass ejection, although there is a smaller peak in the ZDQD data some 6 days earlier.
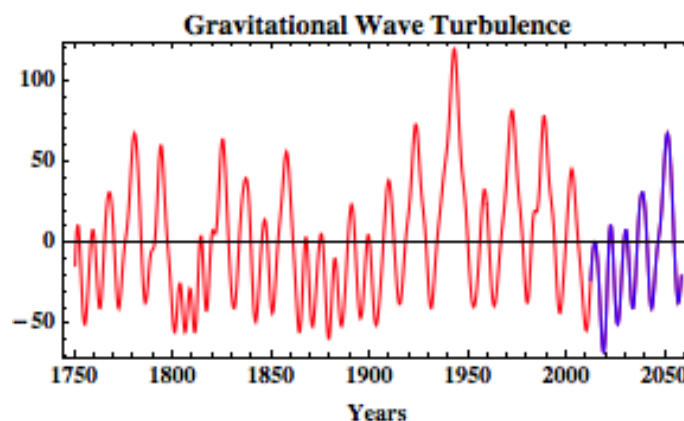

Fig. 7: Plot of Gravitational Wave Turbulence vs years 1749 to present (red plot), based upon Solar Flare counts as a proxy, as shown in Fig. 1. Data adapted from from D. Archibald, Solar Update March 2012 (http://www.warwickhughes.com/blog/?p=2753), [15]. The Solar Flare data has been low-pass filtered using Fast Fourier Transfoms. It is argued herein that the 11 year cycle and longer cycles are caused by galactic space flow turbulence, which can now be easily measured using ZDQD. Beyond 2014 we have used the Fourier amplitudes to extrapolate to 2050 (blue plot), which assumes an ongoing 1/f spectrum. This extrapolation suggests we are facing an epoch of low space flow turbulence, and hence reduced Earth temperatures. The modern warm period extended from 1900s to end of solar cycle 23 (the last cycle in red).
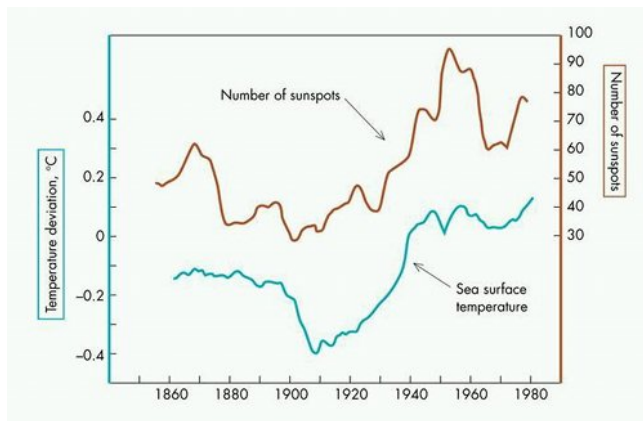
Fig. 8: Shows strong correlations between solar sunspot numbers and Earth sea surface temperature deviations. This, however, does not imply a causal relation between these two phenomena, as was also noted in Fig. 1. It is conjectured herein that the cause is the galactic space flow turbulence, which pumps energy into both the sun and the Earth.

been accepted. However the variation in irradiation is too small to cause the observed Earth temperature fluctuations. See Fig. 8 for correlations between sea temperature and solar flare counts. However the data herein offers a different mechanism, namely that the Earth's climate is affected by changes in the space flow turbulence, which is very evident in Fig. 1, with the causal relation established in Fig. 6. Such space flow fluctuations change the energy of matter, according to $\hbar \mathbf{v} \cdot \mathbf{k}$, as discussed above. These energy changes are the basis of the detection of the space flow turbulence by the ZDQD technique. So this suggests another possible factor affecting the Earth's climate, namely an energy generation that arises from space flow turbulence directly interacting with the Earth. The heating mechanism is that atoms/molecules having a momentary wave vector $\mathbf{k}$ have their energy raised if $\mathbf{k} \cdot \mathbf{v} > 0$. These then scatter with lower energy atoms/molecules and so dissipate the temporary energy lift to the gas in general. The GCP ZDQD data, going back some 18 years, thus provides an incredible data set that could be used to test this conjecture. Another indication of heat production internal to the Earth is that the geoneutrino flux from the decay of uranium-238 and thorium-232 can explain only about 50% of the heat production of the Earth of some 44.2±1.0 TW [14]. So there would appear to be another source of ongoing energy production within the Earth, and this could arise from space-flow turbulence effects.

Beginning Solar Cycle 24 is the weakest in more than 50 years. Fig. 7 shows the low frequency gravitational wave turbulence measure using the solar flare count as a proxy, which follows from the data in Fig. 1, and so permitting an analysis of such turbulence back to 1750. However by using Fourier transforms to extract the frequency spectrum and

phases we may use that data to extrapolate into the future, which is shown in blue in Fig. 7, from mid 2014 to 2050. The prediction is that there will be a reduced energy generation in the Earth system over the next 30 years, as the galactic space turbulence will enter an epoch of reduced turbulence, as in 1860-1910, and resulting in the cooling of the Earth's atmosphere.

7 Conclusions

The discovery of the Zener Diode quantum detector effect has rendered the detection of 3-space flow turbulence, gravitational waves[*], to be trivial and robust. The speed and direction of the flow from such detectors has confirmed the results from earlier experiments, beginning with Michelson and Morley in 1887 using a gas-mode interferometer. Other experimental techniques have used RF speeds in coaxial cables, dual RF coaxial cables and optical fibers, RF speeds in dual coaxial cables, to mention only some: see [1, 4] for recent reviews. The major implication is that space exists, because it is detectable, has significant fractal flow turbulence, and is a complex dynamical system, contrary to the claims since 1905 that space does not exist. The turbulence effects are significant, typically some 20% of the average flow velocity at present. The dynamical theory has become well established by testing against various experimental and observational phenomena [6, 9–11]. Here we have reported evidence that solar flares are caused by major gravitational wave fluctuations. Using Zener Diode gravitational wave detectors and low pass filtering the data now offers the opportunity to predict with some 5 days warning of a major solar flare. As these detectors are so simple they could be included on all future space probes, as a larger scanning region would considerably increase reliability of the new warning system. The data used here comes from the GCP project, which has had Zener diode detectors operating for some 18 years, but was based upon an incorrect assumption that the current fluctuations in the reverse-biased pn junction were random quantum fluctuation, as asserted in the usual interpretation of the quantum theory. However recent experiments [2, 3], and without the XOR gate used in GCP detectors, it was shown that the diode current fluctuations are completely determined by fluctuations in the passing space. Nevertheless the GCP data base represents an enormously significant record of 3-space turbulence, which will permit various studies to be undertaken. A second major discovery is that the long established correlations between Earth temperature fluctuations and solar flare counts is explained by both phenomena being a result of gravitational waves, and not by the very small changes in sun irradiance that accompanies solar flares. This has led to the prediction that there is a diminution epoch of gravitational waves that is already detectable in Figs. 1 and 6, that will

---

[*]The detected gravitational waves are not those of GR. Such waves have never been detected.

result in a cooling of the Earth's atmosphere, as was experienced in earlier Earth epochs when the gravitational waves underwent a period of diminished activity. Dropping temperatures would normally decrease cereal food production, but that may be compensated for by extra growth following form the increased CO_2 levels. We note that the statistical arguments in [16] are invalidated by the discovery of the space flow turbulence effect reported herein: Climate Science has been missing a key physical process until now.

Acknowledgements

References

1. Cahill R.T. Review of Gravitational Wave Detections: Dynamical Space, *Physics International*, 2014, v. 5(1), 49–86.

2. 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.

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

4. 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.

5. Cahill R.T. Characterisation of Low Frequency Gravitational Waves from Dual RF Coaxial-Cable Detector: Fractal Textured Dynamical 3-Space. *Progress in Physics*, 2012, v. 3, 3–10.

6. 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, v. 4, 50–64.

7. Cahill R.T. Process Physics: From Information Theory to Quantum Space and Matter. *Nova Science Pub., New York*, 2005.

8. 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.

9. Cahill R.T. and Kerrigan D. Dynamical Space: Supermassive Black Holes and Cosmic Filaments. *Progress in Physics*, 2011, v. 4, 79–82.

10. Cahill R.T. and Rothall D. Discovery of Uniformly Expanding Universe. *Progress in Physics*, 2012, v. 1, 63–68.

11. Rothall D.P. and Cahill R.T. Dynamical 3-Space: Black Holes in an Expanding Universe, *Progress in Physics*, 2013, v. 4, 25–31.

12. Weaver M. (ed) *et al.* Halloween Space Weather Storms of 2003, NOAA Technical Memorandum OAR SEC-88, 2004.

13. Phillips T. Solar Variability and Terrestrial Climate, http://science.nasa.gov/science-news/science-at-nasa/2013/08jan_sunclimate/

14. KamLAND Collaboration, Partial Radiogenic Heat Model for Earth Revealed by Geoneutrino Measurements. *Nature Geoscience*, 2011, v. 4, 647–651.

15. Archibald D. The Past and Future of Climate, 2010, http://www.davidarchibald.info/papers/Past-and-Future-of-Climate.pdf

16. Kokic P., Crimp S., Howden M. A Probabilistic Analysis of Human Influence on Recent Record Global Mean Temperature Changes, *Climate Risk Management*, 2014, v. 3, 1–12.