Dynamical 3-Space: Energy Non-Conservation, Anisotropic Brownian Motion Experiment and Ocean Temperatures

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In 2014 Jiapei Dai reported evidence of anisotropic Brownian motion of a toluidine blue colloid solution in water. In 2015 Felix Scholkmann analysed the Dai data and detected a sidereal time dependence, indicative of a process driving the preferred Brownian motion diffusion direction to a star-based preferred direction. Here we further analyse the Dai data and extract the RA and Dec of that preferred direction, and relate the data to previous determinations from NASA Spacecraft Earth-flyby Doppler shift data, and other determinations. It is shown that the anisotropic Brownian motion is an anisotropic "heating" generated by 3-space fluctuations: gravitational waves, an effect previously detected in correlations between ocean temperature fluctuations and solar flare counts, with the latter being shown to be a proxy for 3-space fluctuations. The dynamical 3-space does not have a measure of energy content, but can generate energy in matter systems, which amounts to a violation of the 1st Law of Thermodynamics.

1 Introduction

In 2014 Jiapei Dai [1] reported evidence of anisotropic Brownian motion[*] of a toluidine blue colloid[†] solution in water. In 2014 Felix Scholkmann [2] analysed the Dai data and in 2015 [3] detected a sidereal time dependence, indicative of a process driving the preferred Brownian motion diffusion direction to a star-based preferred direction. Here we further analyse the Dai data and extract the RA and Dec of that preferred direction, and relate the data to previous determinations from NASA spacecraft Earth-flyby Doppler shift data, and other determinations [4, 5]. It is shown that the anisotropic Brownian motion is an anisotropic "heating" generated by 3-space fluctuations: gravitational waves, an effect previously detected in correlations between ocean temperature fluctuations and solar flare counts, with the latter being shown to be a proxy for 3-space fluctuations. The dynamical 3-space does not have a measure of energy content, but can generate energy in matter systems, which amounts to a violation of the 1st Law of Thermodynamics.

This dynamical 3-space turbulence induced heating as revealed by anisotropic Brownian motion is a laboratory technique for studying the physics of ocean heating [8], which is a key component of climate change, as atmospheric water vapour is the dominant green house gas. As well the data confirms a previous discovery [11, 12] that when the 3-space travels more deeply through the earth the 3-space flow turbulence /gravitational waves is increased.

2 Anisotropic Brownian Motion

Dai in Wuhan City detected anisotropic Brownian motion by loading a small drop of toluidine blue solution into a container of water. The diffusion pattern was photographed starting within 30 sec of loading the water cell and then once every ten minutes until the end of observations; 40min [1]. The images were analysed using image analysis software. The observations were performed 24 times per day, and repeated from December 22, 2011 to March 23, 2013. The image of the diffusion anisotropy is illustrated in Fig.1, with directions measured from East in a clockwise direction. Dai reported the preferred direction of diffusion from 15 days, plotted against Wuhan Solar Time. In Fig.3 that data has been replotted against Local Sidereal Time for Wuhan City. We now analyse that data from the point of view of a preferred 3-space velocity, where the Right Ascension, RA, is defined by when the preferred diffusion direction is from S to N. The Declination is to be determined by the dynamic range of the diffusion direction over one day, as in Fig.5. We report herein that the anisotropic Brownian motion data confirms various properties of the 3-space flow previously reported [4, 5, 8, 11–14].

[*]Brownian motion is named after Robert Brown who was the botanist on the voyage in 1801 by Captain Matthew Flinders on HMS Investigator to *Terra Australis*. Flinders University is named after this explorer and scientist. Flinders explained magnetic compass errors, and invented the Flinders Bar to cancel the errors, measured sea temperatures and salinity, and performed pendulum experiments. Brown collected many Australian plants, and on his return to London discovered, using a microscope, the effect now known as Brownian motion, using pollen collected during the voyage, and which was the 1st indication of atomic structure, as this was proposed to be caused by the random motion of the pollen particles driven by collisions with atoms or molecules [6, 7]. The campus *Flinders Investigator Garden* was initiated by the physicist Dr Lance McCarthy to commemorate Flinders and Brown.

[†]Toluidine is a dye used to stain biological tissues.

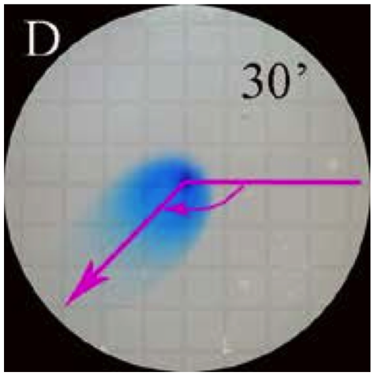

Figure 1: Illustration of anisotropic diffusion of the toluidine blue solution in water, 30 min after inserting drop. The preferred direction is measured clockwise in degrees from East. Reproduced from [1].

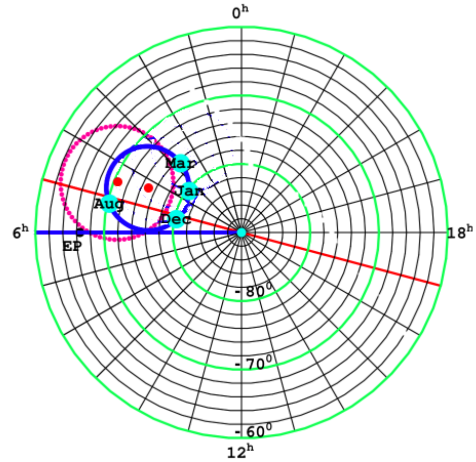

Figure 2: South celestial pole region. The dot (red) at RA=4.3^h, Dec=75°S, and with speed 486km/s, is the year averaged direction of motion of the solar system through space determined from NASA spacecraft Earth-flyby Doppler shifts [14], as revealed by the EM radiation speed anisotropy. The thick (blue) 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 [14]. 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 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 [4, 5, 11–14]. 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 [15, 16].

The Schrödingier equation must be extended to include the dynamical space [17]

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

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 locate structures. This is not an aether embedded in a non-dynamical space, but a dynamical space which induces an embedding space or coordinate system. 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 [15, 16]. This minimal generalisation of the original Schrödingier equation arises from the replacement $\partial/\partial t \to \partial/\partial t + \mathbf{v}.\nabla$, the Euler derivative, 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 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 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 [4], dating back to the 1st detection by the Michelson-Morley experiment of 1887, for which the appropriate neo-Lorentz Relativity [9, 10] calibration was not then available, 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, [14], to determine the anisotropy of the speed of EM waves, as indicated in Fig.2. All successful detection techniques have observed significant fluctuations in speed and direction: these are the actual "gravitational waves", because they are associated with gravitational and other effects*. In particular we report here the role of these waves in Brownian motion, solar flare excitations and Earth climate science.

*Note that vacuum-mode Michelson interferometers, such as LIGO, cannot detect these wave effects. Only dielectric-mode versions have detected such waves, although there are a variety of other successful techniques [4, 5].

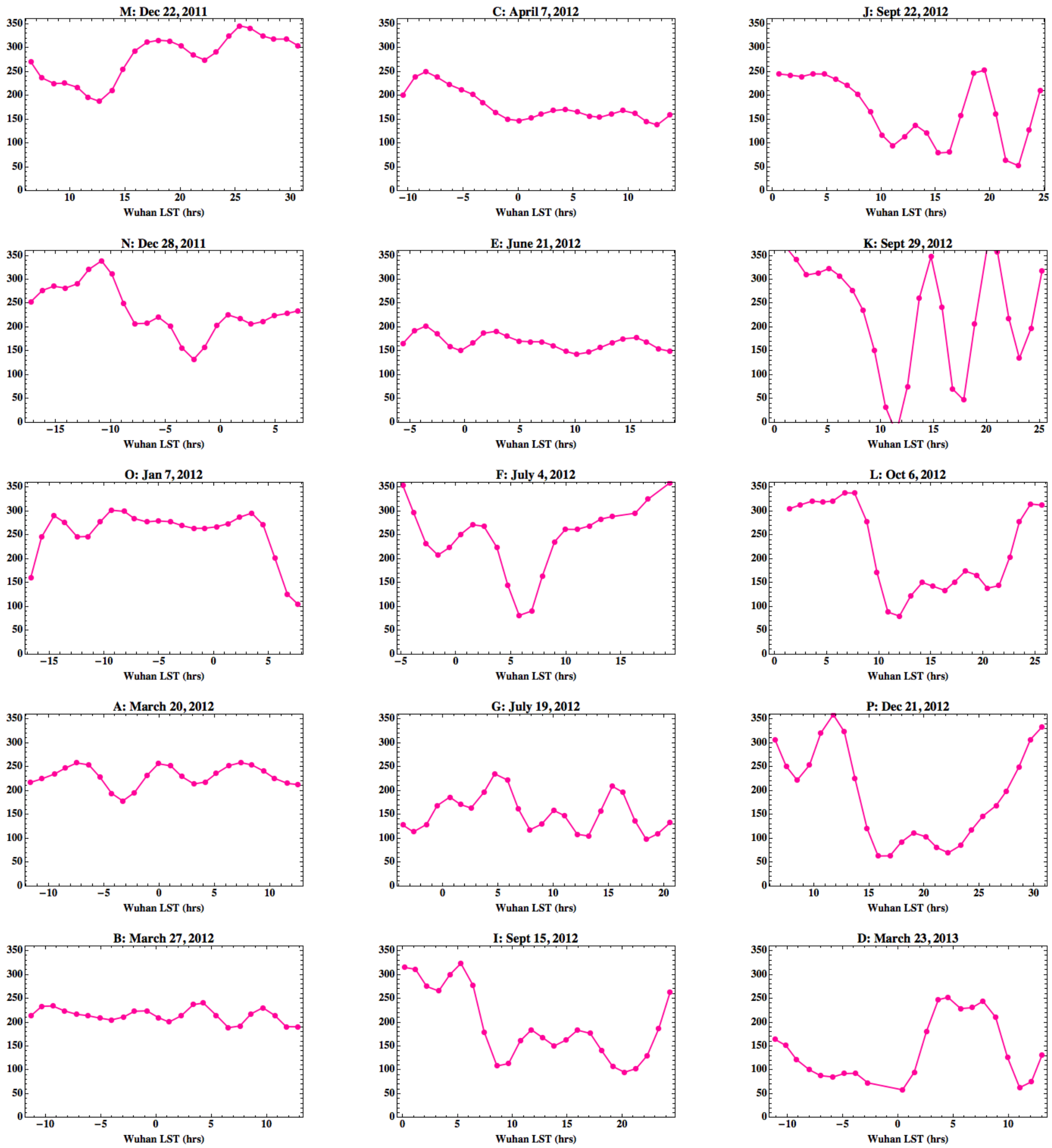

Figure 3: Dai data [1], showing preferred direction of colloidal diffusion, plotted against Wuhan Local Sidereal Time (LST), for the various indicated days. The coding M, N,.. refers to the labelling in [1], which reported the data against Wuhan local solar time. The preferred direction of diffusion is measured as indicated in Fig.1.

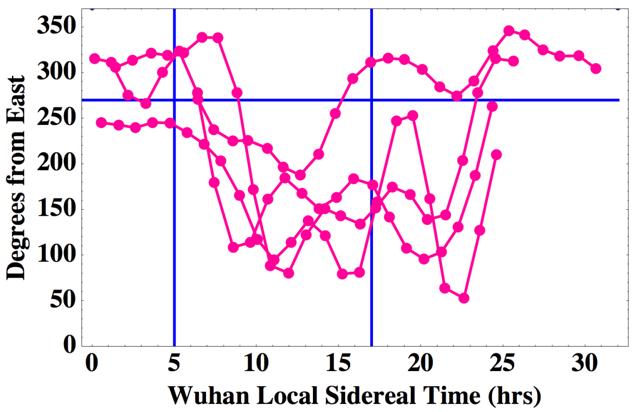

Figure 4: Plot of the better data from Fig.3: M, I, J, L. As shown in Fig.8 these days correspond to minima in 3-space fluctuations: gravitational waves. These days show trend of preferred direction to be from South to North (270°) at ∼5 hrs LST. A similar trend might be expected for 17hrs LST, but is not seen in all days shown. This is because at this approximate LST the space flow passes more deeply through the Earth, see Fig.6, which results in considerable increase in turbulence, as discovered using Zener Diode Quantum Detectors for space flow, as shown in Fig.7.

A significant effect follows from (1), namely the emergence of gravity as a quantum effect: an Ehrenfest wave-packet analysis reveals the classical limit and shows that the acceleration of a localised wave packet, due to the space terms alone (when $V(\mathbf{r},t) = 0$), given by $\mathbf{g} = d^2\langle\mathbf{r}\rangle/dt^2$, [17], 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.

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,

$$\mathbf{a}(\mathbf{r},t) = \lim_{\Delta t\to 0}\frac{\mathbf{v}(\mathbf{r}+\mathbf{v}(\mathbf{r},t)\Delta t, t+\Delta t) - \mathbf{v}(\mathbf{r},t)}{\Delta t} = \frac{\partial \mathbf{v}}{\partial t} + (\mathbf{v}\cdot\nabla)\mathbf{v} \tag{3}$$

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

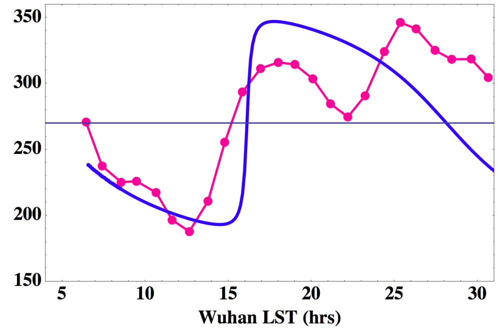

Figure 5: Plot of Dai data vs Wuhan LST for Dec 22, 2011 (plot M in Fig.3). Smooth curve (blue) is predicted form for RA=5hrs, Dec=60°S. The RA is defined by when dynamical 3-space flow direction is from S to N, here RA 5hrs and 17hrs. The Dec determines the variation in direction, here 270° ±40°. Note the increased turbulence, manifesting as fluctuations in direction of the flow, when the flow is more deeply through th Earth. For Dec 8, 1992, the NASA Doppler shift data gave RA=5.23hrs, Dec=80°S, see Fig.2 and [14].

suggests, from (2) and (3), that the simplest dynamical equation for $\mathbf{v}(\mathbf{r},t)$ is

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

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

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

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 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, $\alpha = e^2/\hbar c$, [20]. 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

*With vorticity $\nabla\times\mathbf{v}\neq\mathbf{0}$ and relativistic effects, the acceleration of matter becomes different from the acceleration of space [15].

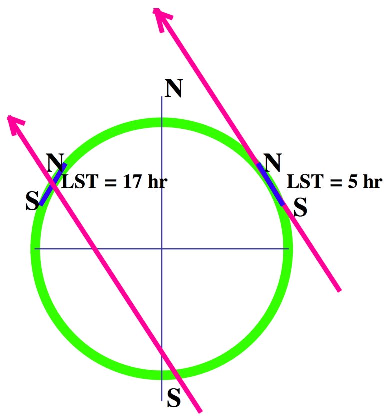

Figure 6: Cross section of Earth showing Wuhan horizontal planes and the local N and S directions at Local Sidereal Times of 5 hr and 17 hr. Also shown is dynamical 3-space flow direction, with a Declination of -60°. At LST of ∼17hr the flow passes most deeply into the Earth, resulting in significant turbulence, as revealed by the Brownian motion data in Figs 4 and 5, and also by the Quantum Detector data in Fig.7 .

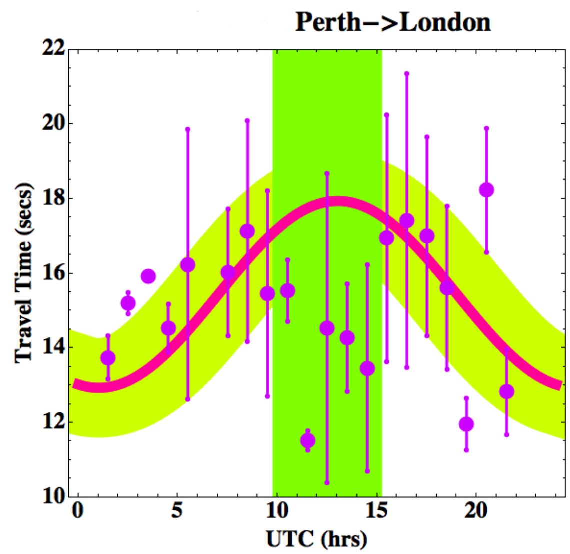

Figure 7: Travel times from Zener Diode Quantum Detector data for Perth→London correlation analysis for Jan 1, 2013. The data in each 1 hr interval has been binned, and the average and rms shown. The thick (red line) shows best fit to data using uniform travel time, but after excluding those data points between 10 and 15hrs UTC, indicated by vertical band. Those data points are not consistent with the uniform travel time modelling, and suggest a scattering process when the waves pass deeper into the Earth. This 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 travel time fluctuations, corresponding to speed fluctuation of +/- 17km/s. Actual fluctuations are larger than this, as 1st observed by Michelson-Morley in 1887 and by Miller in 1925/26.

for such a term [18], and we find that the space dynamics then requires an extra term:

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

where δ has the dimensions of length, and appears to be a very small Planck-like length [18]. 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, [15, 16]. 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 [18,20], 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, [20], to which matter is attracted and coalesces into gas clouds, stars and galaxies.

The dynamical space equation (5) 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, 18–20]. 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.

4 Analysing Brownian Motion Data

Dynamical space has no energy density measure. Nevertheless it can generate energy into matter. via the $-i\hbar\mathbf{v}\cdot\nabla$ term in the Hamiltonian in (1). For a plane wave $\psi = e^{i\mathbf{k}\cdot\mathbf{r}-i\omega t}$ this results in an energy shift $E=\hbar\omega \to E+\hbar\mathbf{k}\cdot\mathbf{v}$, without any measure of a change in energy of space, as there is no such measure. Thus this amounts to the discovery that the Principle of Energy Conservation does not apply to energetic processes driven by space.

The direction of the 3-space velocity field relative to the earth frame of reference has been repeatedly measured, and data from spacecraft Earth-flyby Doppler shift observations by NASA is shown in Fig.2. That technique uses the fact that the speed of light/EM waves in vacuum is c wrt the local space, and not wrt an arbitrary observer. The most recent and simplest technique uses fluctuations in the electron current flow through reverse-biased pn junction diodes, using two detectors separated by 25cm [11, 12]. That technique does not

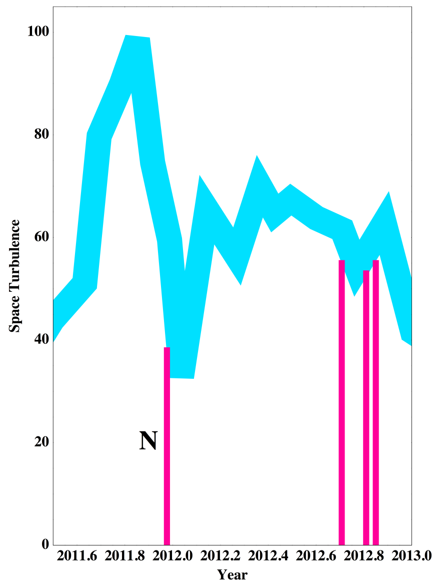

Figure 8: Measure of Space Turbulence using monthly averaged Solar Flare counts as a proxy, from Space Weather Prediction centre, covering the time period of the Dai experiment, [1]. It was shown in [8] that Solar Flare counts are an accurate proxy for the dynamical 3-space turbulence. The Dai data was collected from December 2011 to March 2013, partly covering Solar Cycle 24. The 4 vertical lines are the dates for the best Dai data, shown in Fig.4. The Solar Flare counts have been moved backwards in time by 5 days, as it was shown in [8] that it takes some 5 days for a solar flare event to erupt after a significant 3-space fluctuation. We thus see that the best data occurs when the 3-space fluctuations were minimal, namely days M, I, J, L, with the smallest turbulence being for day N.

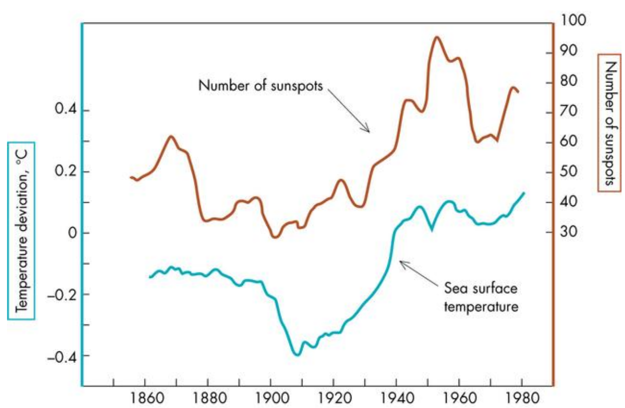

Figure 9: Shows strong correlations between solar sunspot numbers, and thus dynamical 3-space turbulence, and Earth sea surface temperature deviations (from http://cse.ssl.berkeley.edu/bmendez/ay10/2000/notes/dis2.html). As shown in [8] the solar flare count is an accurate proxy for dynamical 3-space turbulence. It was conjectured in [8] that the 3-space flow turbulence generates energy in both the Sun and the Earth. The Dai Brownian diffusion data [1] is herein interpreted as a preferred heating direction caused by the 3-space flow.

involve light speed anisotropy, but gives the same speed and direction of the 3-space, and extensive 3-space flow fluctuations.

The Dai data in Fig.3 reveals a complex behaviour, with not all data revealing a RA for the preferred flow consistent with, for example, the spacecraft Earth-flyby data, Fig.2. However this is explainable by two key observations. First the fluctuations in the 3-space flow, which manifest as changes in both speed and direction, are shown in Fig.8, and deduced from Solar Flare count rates, following the discovery in [8] that Solar Flares are caused by major 3-space fluctuations, some 5 days after that fluctuation. In Fig.8 we see that only 4 of the Dai data dates coincide with the dates of the weakest 3-space fluctuations, namely days M, I, J, L. When the data for these days is plotted, as in Fig.4, we see that the RA cluster around 5hrs Local Sidereal Time, as we would expect from Fig.2. However we would also expect to see the data crossing the due N direction (270°) some 12 hours later. However the data in Fig.4 shows much noisier variations. This second key observation is that this is also expected as during these times the 3-space flow has passed deeply into the earth, as shown in Fig.6, and this results in increased turbulence in both speed and direction, as reported in [11] and Fig.7. One consequence of this is that future studies of anisotropic Brownian motion should be perfumed well into the southern hemisphere. Finally, from the 3-space turbulence, Fig.8, we expect the best quality data, being least affected by 3-space turbulence, would be for day M. That data is shown in Fig.5, which gives an approximate RA=5hrs, Dec=60°S, which is not too different from the December data point in the Earth-flyby data in Fig.2.

That the known characteristics of the 3-space flow agree with results from the anisotropy of the Brownian motion data suggests a simple mechanism, namely that the 3-space flow generates an energy shift in the water molecules; $E \to E + \hbar\mathbf{k}\cdot\mathbf{v}$, where $\mathbf{k}$ is the wavenumber vector for water molecules, and that this is largest for water molecules moving in the direction of $\mathbf{v}$. This results in water molecules moving in the direction of $\mathbf{v}$ having a greater kinetic energy, and imparting more momentum to the toluidine colloidal particles than water molecules moving in the opposite direction. So the $-i\hbar\mathbf{v}\cdot\nabla$ term gives rise to an enhanced Brownian diffusion in the direction of $\mathbf{v}$.

A similar effect was observed by Shnoll [21] in which the α decay rate of ^{239}Pu is directional dependent. This is also explained by the $-i\hbar\mathbf{v}\cdot\nabla$ term, as it causes the α kinetic energy to be different in different directions related to $\mathbf{v}$, and so affects the quantum tunnelling process, with more α emerging in the direction of $\mathbf{v}$*.

Again this energy generation effect also explains the operation of the Zener diode quantum detectors for detecting $\mathbf{v}$, where here the energy shift is to electrons, which affects their

*This corrects comments in [12] re the Pu α decay rate.

quantum tunnelling process in a reverse-biased diode [12] .

5 Energy Non-Conservation and Climate Science

There have been many studies noting correlations between solar cycles and changes in the Earth temperature. 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 been accepted. However the variation in irradiation is too small to cause the observed Earth temperature fluctuations. Fig.9 shows strong correlations between sea temperature and solar flare counts, and solar flare counts are simply a proxy for 3-space turbulence, as shown in [8]. Various data are thus implying that increased 3-space turbulence is responsible for the heating of the ocean. The mechanism is again coming from the $-i\hbar\mathbf{v}\cdot\nabla$ term, with increased $\mathbf{v}$ leading to maximum energy generation for water molecules moving in the direction of $\mathbf{v}$. This energy is subsequently dissipated to other less energetic water molecules, resulting in an overall heating effect. This heating then explains why the earth's temperature record so closely tracks solar flare counts. Fundamentally then it is implied that the Earth's climate is controlled by a non-conservation of energy process.

6 Conclusions

The Dai anisotropic Brownian Motion experiment is another demonstration of the existence of the dynamical 3-space and its characteristics, displaying turbulence and energy non- conservation. All phenomena in physics, from electromagnetic to gravitational anomalies, galactic rotations and cosmic uniform expansion, and without "dark matter" nor "dark energy" have been investigated, and include 3-space filaments and black hole-filament cosmic networks, and all these phenomena are constant with the existence of the dynamical 3-space. [18–20]. This is not the 1st time that the effects of the dynamical space process have been discovered: see the works of N. Tesla, T.T. Brown, W. Reich, T.H. Moray and others. These experimentalists generally referred to the dynamical space as a cosmic energy, although Reich named it Orgone Energy [22]. Of particular relevance here are the phenomena observed by Reich using an Orgone Accumulator: this is a box formed from alternating layers of metal and insulator. He observed slightly raised pulsating temperatures, raised nuclear decay count rates, and fluctuating light emission, all within the box. These phenomena appear to suggest that the box enhances dynamical space fluctuations. Comparing the reverse-biased pn diode quantum detector tunnelling current for two detectors, one inside and one outside of the box would give confirmation of this interpretation.

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