Dynamical 3-Space: Anisotropic Brownian Motion Experiment

Reginald T. Cahill

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

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.

1 Introduction

In 2014 Jiapei Dai [1] reported evidence of anisotropic Brownian motion, and in 2015 Felix Scholkmann [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 [5]. It is shown that the anisotropic Brownian motion is an anisotropic "heating" generated by the dynamical 3-space [4].

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 [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 Figure 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. 2 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. 4. We report herein that the anisotropic Brownian motion data confirms various properties of the 3-space flow previously reported [5].

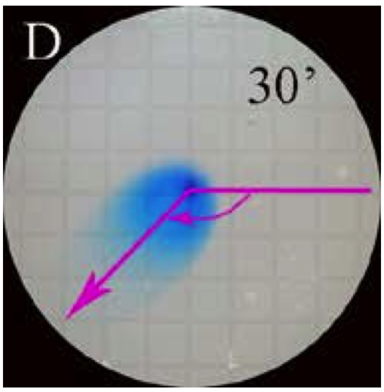

Fig. 1: Illustration of anisotropic diffusion of the toluidine blue solution in water, 30 min after inserting drop. The preferred direction is measured clockwise in degrees from East. Reproduced from [1].

3 Dynamical 3-space

The Schrödinger equation must be extended to include the dynamical space [6]

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

Here $\mathbf{v}(\mathbf{r},t)$ is the velocity field describing the dynamical space at a classical field level, [4], 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. This minimal generalisation of the original Schrödinger 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 extra $\nabla\cdot\mathbf{v}$ term in (1) is required to make the hamiltonian in (1) hermitian.

4 Analysing Brownian motion data

For a plane wave $\psi = e^{i\mathbf{k}\cdot\mathbf{r}-i\omega t}$, for water molecules, this results in an energy shift $E = \hbar\omega \to E + \hbar\mathbf{k}\cdot\mathbf{v}$. The Dai data in Fig. 2 reveals a complex behaviour, with not all data revealing a RA for the preferred flow. However this is explainable by two key observations. First the fluctuations in the 3-space

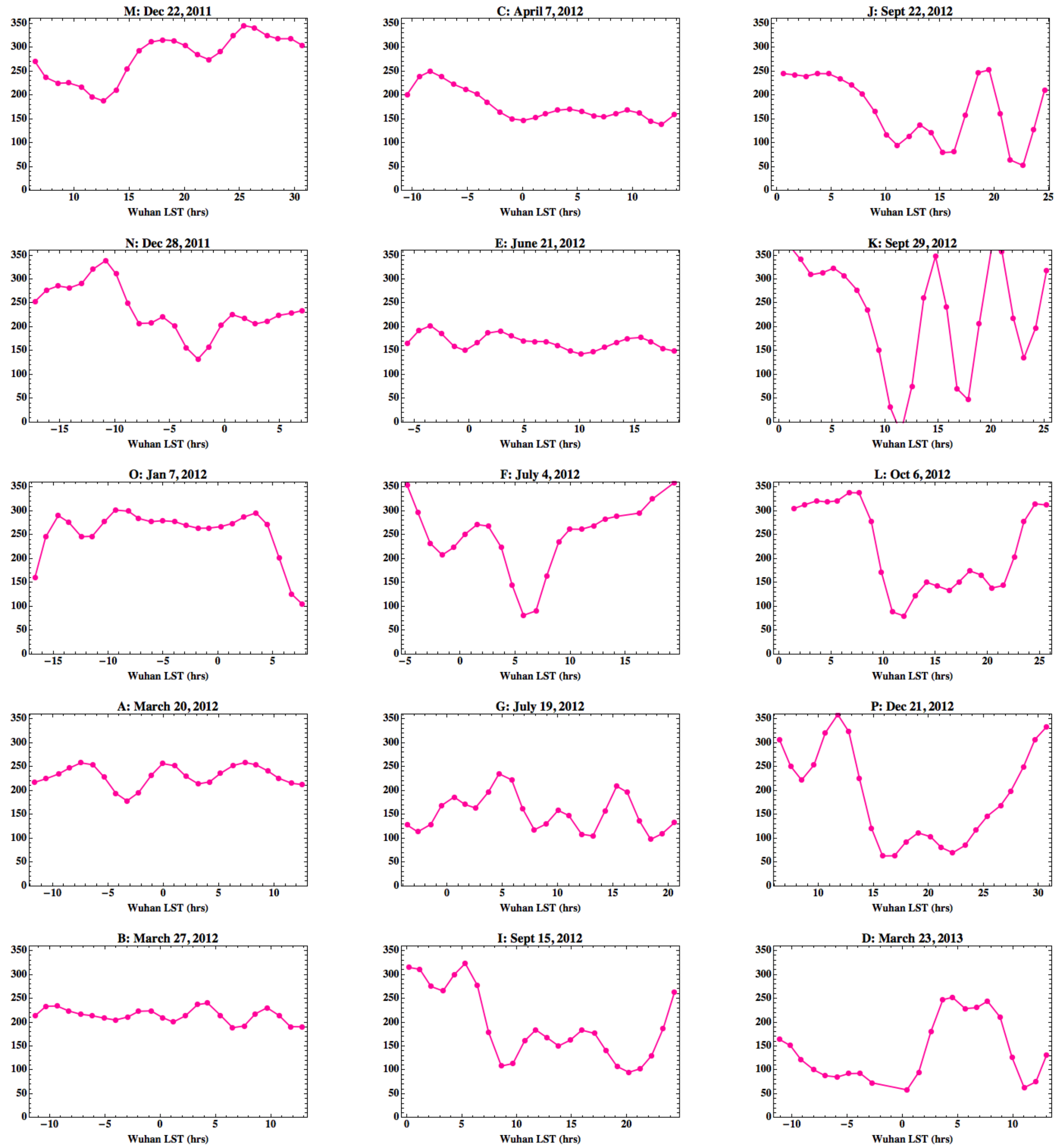

Fig. 2: Dai data [1], showing preferred direction of colloidal diffusion, plotted against Wuhan Local Sidereal Time (LST), for the various indicated days. The coding M, N, ... refers to the labelling in [1], which reported the data against Wuhan local solar time. The preferred direction of diffusion is measured as indicated in Fig. 1.

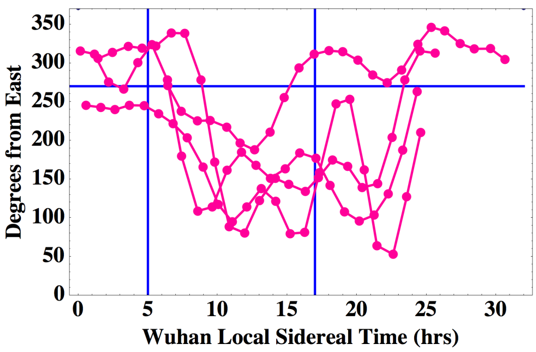

Fig. 3: Plot of the better data from Fig. 2: M, I, J, L. These days show trend of preferred direction to be from South to North (270°) at ~5 hrs LST. A similar trend might be expected for 17hrs LST, but is not seen in all days shown. This is because at this approximate LST the space flow passes more deeply through the Earth, see Fig. 5, which results in considerable increase in turbulence.

flow manifest as changes in both speed and direction. When the data for the better days is plotted, as in Fig. 3, we see that the RA cluster around 5hrs Local Sidereal Time. However we would also expect to see the data crossing the due N direction (270°) some 12 hours later. However the data in Fig. 3 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. 5, and this results in increased turbulence in both speed and direction. One consequence of this is that future studies of anisotropic Brownian motion should be performed well into the southern hemisphere. Finally, from the 3-space turbulence, we expect the best quality data, being least affected by 3-space turbulence, would be for day M. That data is shown in Fig. 4, which gives an approximate RA=5hrs, Dec=60°S. This is consistent with the RA and Dec for December from the NASA Doppler shift data [5].

5 Conclusion

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 [7] 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 $\mathbf{v}$.

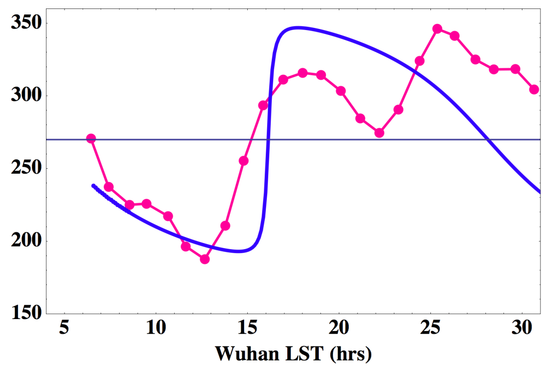

Fig. 4: Plot of Dai data vs Wuhan LST for Dec 22, 2011 (plot M in Fig. 2). Smooth curve (blue) is predicted form for RA=5hrs, Dec=60°S. The RA is defined by when dynamical 3-space flow direction is from S to N, here RA 5hrs and 17hrs. The Dec determines the variation in direction, here 270° ± 40°. Note the increased turbulence, manifesting as fluctuations in direction of the flow, when the flow is more deeply through the Earth. For Dec 8, 1992, the NASA Doppler shift data gave RA=5.23hrs, Dec=80°S, [5].

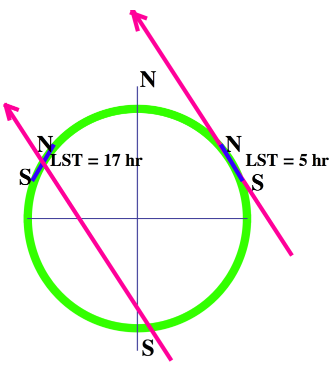

Fig. 5: Cross section of Earth showing Wuhan horizontal planes and the local N and S directions at Local Sidereal Times of 5 hr and 17 hr. Also shown is dynamical 3-space flow direction, with a Declination of -60°. At LST of ~17hr the flow passes most deeply into the Earth, resulting in significant turbulence,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

Submitted on April 2, 2015 / Revised on April 17, 2015 / Accepted on April 20, 2015

References

1. Dai J. Macroscopic Anisotropic Brownian Motion is Related to the Directional Movement of a "Universe Field". *Natural Science*, 2014, v. 6 (2), 54–58.
2. Scholkmann F. Indications for a Diurnal and Annual Variation in the Anisotropy of Diffusion Patterns – A Reanalysis of Data Presented by J. Dai (2014, Nat. Sci.). *Progress in Physics*, 2014, v. 10 (4), 232–235.
3. Scholkmann F. Solar-Time or Sidereal-Time Dependent? The Diurnal Variation in the Anisotropy of Diffusion Patterns Observed by J. Dai (2014, Nat. Sci.). *Progress in Physics*, 2015, v. 11 (2), 137–138.

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. 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. 5 (4), 50–64.
6. Cahill R. T. Dynamical Fractal 3-Space and the Generalised Schrödinger Equation: Equivalence Principle and Vorticity Effects. *Progress in Physics*, 2006, v. 2 (1), 27–34.
7. Shnoll S. E. Cosmophysical Factors in Stochastic Processes. American Research Press, Rehoboth, New Mexico, USA, 2012. http://www.ptep-online.com.