III: Preliminary Evidence for a New Type of Radiation in Sunlight*

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(Dated: November 22, 2022)

Firstly, a special microscope technique, presented in a previous paper, is used to show that there is a component of sunlight (not photons) which creates ordered structures in water and hence lowers the entropy level. These structures persist for at least 3 weeks. Secondly, we use another novel method to search for this new type of radiation in sunlight, if any, which penetrates 12 micron aluminium foil and lowers the entropy level of water. Off-line we measured viscosity to detect changes in entropy more precisely. Evidence is presented for a new type of radiation in sunlight, which penetrates the Al foil and increases the viscosity of water, hence lowers its entropy level. We repeated the experiment and find it is reproducible. The reduced entropy levels persist in both experiments for at least for 5 to 17 weeks after exposure respectively. The effect is 10.1 times the systematic errors, and 5.6 and 10.2 σ greater than the controls (incandescent light and non-irradiated) respectively. Neither WISPs nor light-shining-through-wall (LSW) effects can explain these results. In a previous paper, we make the conjecture that quantum mechanics can be unified with chronometric invariant general relativity (CIGR) and the standard model embedded within it. This new type of radiation in sunlight provides additional evidence for the second sector of this unified theory.

Keywords: sunlight; new solar radiation; negative entropy; unification; second sector; mirror sector; Order force

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I. INTRODUCTION

Sunlight is known to consist of photons, together with other types of radiation such as neutrinos, alpha particles and protons. It is unlikely that there is a new type of radiation in sunlight, unless firstly there are discrepancies in solar physics, and secondly there is some kind of new physics which predicts such a new type of radiation. Thirdly, if this hypothetical new radiation has properties which make it difficult to detect by normal methods, that would explain why it as not been detected before.

Firstly, there is some evidence for discrepancies in solar physics. For example, the photospheric abundances of the most abundant heavy elements, have been revised downwards.[1] When the standard solar models are implemented with these revised abundances, they deviate significantly from the solar structure as determined by helioseismic analysis.[2] Furthermore, there is no agreed explanation for energy production in the solar corona, although there are candidates for this.[3] There are a number of other problems outstanding in solar physics.[4] So it is possible that there are things going on in the sun which we do not know about or understand.

Secondly, the new physics is within the framework of the low energy frontier of particle physics,[5] but with a difference. In the 1930s, Landau pointed out that general relativity is not complete because it does not allow for the Observer's reference frame.[6] Zelmanov correctly introduced the Observer using chronometric invariants.[7, 8] Borissova and Rabounski have shown that chronometric invariant general relativity (CIGR) requires the existence of a second sector (mirror world) with a second time dimension directed from the future to the past.[9] In the previous phenomenology paper,[10] we make the photo-mirror hypothesis that visible photons can lower the entropy level (by means of the Brittin and Gamow effect),[11] and thereby switch the arrow of time into the mirror world state of CIGR.

Furthermore, in the previous experimental paper,[12] we present separate experimental evidence for this second time dimension in mirror space-time, and also for the photo-mirror effect. We then made the conjecture that quantum mechanics can be unified with chronometric invariant general relativity (instead of with normal general relativity), because CIGR also includes the Observer. We predict that mirror space-time will form the basis for the hidden sector of this new theory, but different from that predicted by some other theories, and by some astronomers.[13] We also suggest that there may be new states of matter and/or new forces in this mirror sector. A key property of the mirror

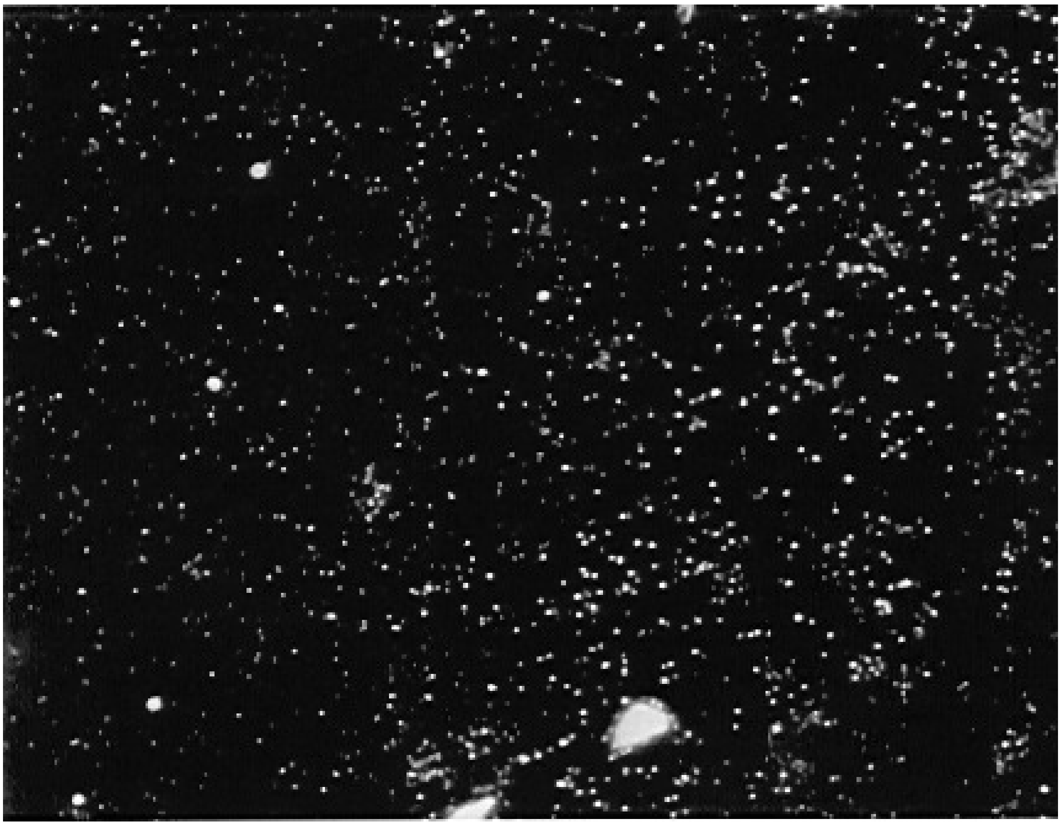

FIG. 1: Hidden domains in water exposed to halogen light for 37.5 hours, revealed by a novel microscope technique using side illumination. These are 0.2 to 1.5 microns in size, with a few exceptions.

sector is that the second law of thermodynamics does not apply, at least not in its present form (because time there is directed from the future to the past). *Therefore phenomena in the mirror sector will tend to lower entropy levels with respect to our time.* This could be the new physics for a new type of radiation in sunlight.

Thirdly, normal physics experiments do not look for types of radiation which lower entropy levels. In fact most particle interactions in normal 4-D space-time tend to raise entropy levels (e.g. cosmic ray showers). So this would explain why a new type of radiation which lowers entropy levels has not been detected before.

II. MICROSCOPE EXPERIMENT ON SUNLIGHT AND WATER

We describe the following experiments, which show evidence for a new type of radiation in sunlight, in some detail so that others can reproduce these results.

In our previous experimental paper, we have shown that water can detect processes

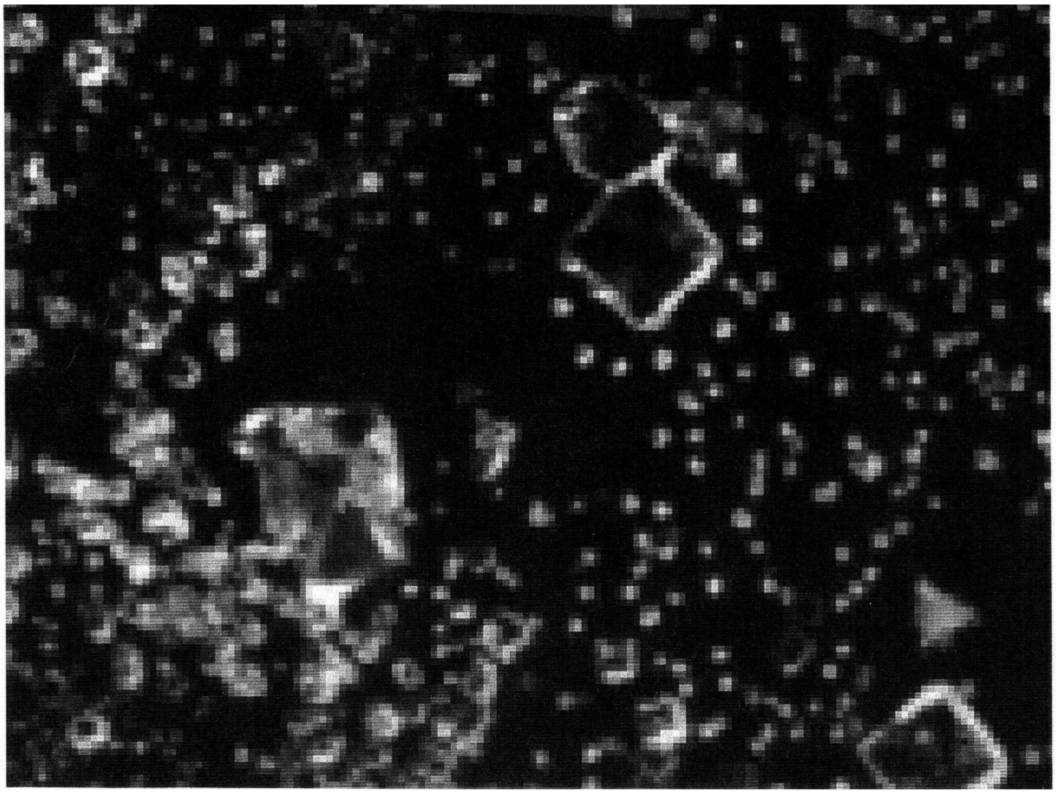

FIG. 2: Hidden "structures" and domains produced by sunlight shining on water, revealed 3 weeks after exposure by the same method used for figure 1 but with software magnification x3. They are in the size range 1 - 12 microns. The smaller ones are those produced by photons, the larger ones, some of which are square, possibly pyramidal, are the subject of investigation here.

which lower entropy levels. In particular, water is sensitive to the effects of individual photons, both from the sun and from a halogen lamp, and will preserve the effects they produce. We found evidence that photons create hidden domains in water, which can be revealed by a special microscope technique.[12] An example of these domains, which persist, are shown in figure 1. We found evidence that they are in the mirror space-time of CIGR.

In our previous work, we found evidence for an unexpected property of sunlight. In the exploratory experiment,[12] sunlight and halogen light reduced the diffusion constant by a similar amount of 23% and 22% (i.e. reduced the entropy by 4.7% and 4.4%) respectively. The difference between these two signals (δ = -0.01 $\pm$ .029 μm^2/sec) is not statistically significant. Therefore within these errors, there is apparently no difference between sunlight and halogen light. The light from a halogen lamp clearly consists of photons, and so these results suggest that sunlight does too, within the errors.

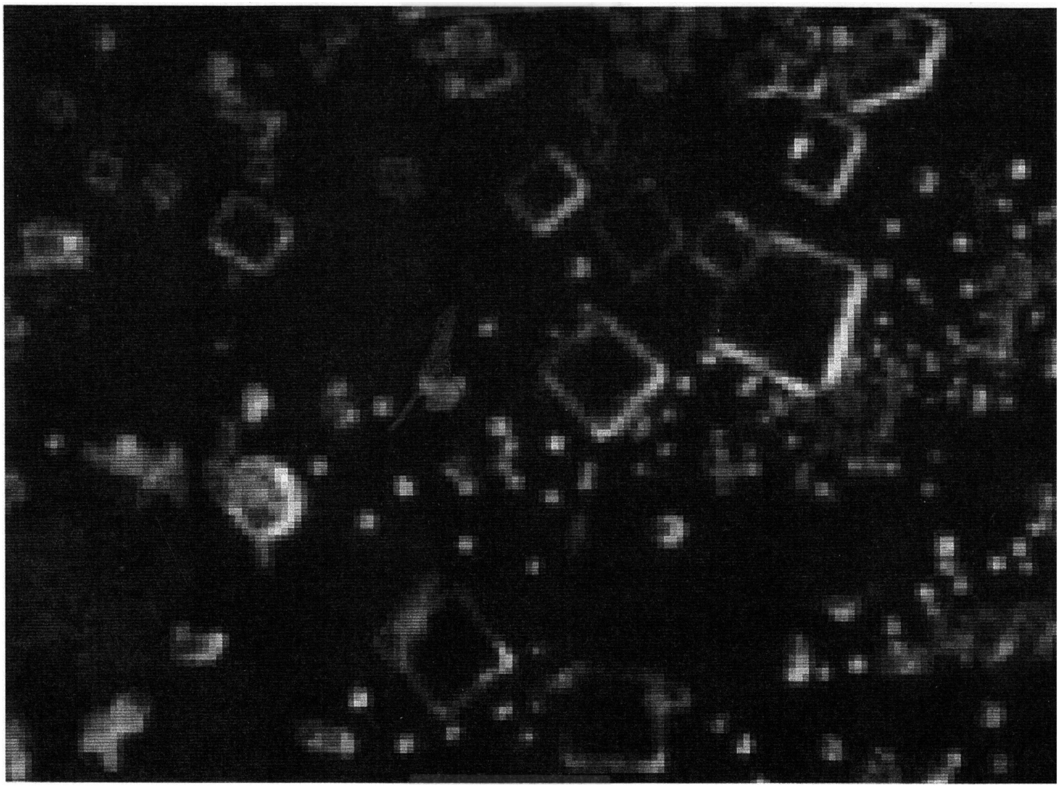

FIG. 3: A second example of the hidden effects of sunlight on water made 3 weeks after exposure. This also shows structures in the 1 to 12 micron range, including some square ones. Thus the effect is reproducible.

However, we had some separate evidence which suggests that sunlight causes peculiar effects not produced by photons from a halogen lamp. The special microscope technique used to reveal hidden domains in the water, shows 0.2 to 1.5 micron structures produced by halogen photons in figure 1. Figure 2 shows the effect of sunlight shining on water for 8 days, using the same microscope technique, except that the magnification is software enhanced x3. We see that sunlight produces larger structures in the range approximately 1 to 12 microns. The smaller ones ($\approx$ 1 micron) are presumably produced by visible photons, as in figure 1. However, the larger ones, some of which are square, possibly pyramidal in shape, appear to be a completely different phenomenon. These are also shown in figure 3. So the effect is reproducible.

The main difference between halogen light and sunlight is the UV in the latter. So we exposed water to a mercury lamp producing UV at 365.4 and 253.7 nm, and the results are shown in figure 4, which is similar to figure 1 (apart from the over-exposure in the middle). The UV domains are in the range 0.5 to 2 microns, except where they start to merge. So the larger structures shown in figures 2 and 3 are not produced by UV.

FIG. 4: Hidden domains and “structures” in water after 29.5 hours exposure to a mercury UV lamp. It is over-exposed in the centre and “structures” there have merged together. However, away from the centre it is similar to figure 1, with no sign of the large structures seen in figures 2 and 3. Therefore these are not cause by UV.

There are two details to note here, which will be discussed again at the end of the paper. We have found in our previous paper,[12] that the domains produced by photons are mildly spheroidal in shape, and surrounded by the membrane predicted by CIGR, which scatters light and makes them visible, as shown in figure 1. The square or pyramidal shape of these larger structures is low entropy, but clearly very different. Water is normally transparent. However, these larger structures are visible, and so they are scattering side illumination approximately 90 degrees into the microscope. Therefore the water in these structures must have changed in some way to make them visible. The simplest explanation is that these orderly (square) structures are in mirror space-time and surrounded by the membrane predicted by CIGR.

Whilst this result is perhaps not proof that there is a new type of radiation in sunlight, it suggests that indeed that could be the case. So we therefore decided to do an experiment to find additional evidence for this possible new type of radiation in sunlight.

A. Design of Sunlight Experiment

In order to design an experiment to detect this hypothetical new type of radiation, we need to consider its properties. Firstly, figures 2 and 3 suggests that it produces hidden ordered structures in the water, so it lowers entropy levels, which probably explains why it has not been detected before. So any detector would have to be sensitive to such effects. Secondly, photons are likely to be a significant background, which the apparatus has to eliminate. Thirdly the changes to the diffusion constant are sufficiently small, that we would need more sensitive techniques to detect any such changes.

We chose to use water as the detector since, as we have shown in the previous experimental paper, it is easily switched into the mirror world state by phenomena which lower the entropy level. It is very sensitive and can even detect the effects of single photons. Furthermore the reduced entropy levels persist, so they can be detected off-line. (NB Water is a bit like the photographic emulsions used in the early days of particle physics.) We decided to use aluminium foil to filter out photons by reflection. We decided to use a viscometer to detect small changes in the viscosity and hence diffusion constant. In view of the wide spread in the data points in the viscometer data presented in the previous paper,[12] this may seem a mistaken choice. However, experimentation showed that the main source of this came from photons. When the detector is wrapped in aluminium foil to exclude photons, the spread in the data points of repeated measurements is much closer to non-irradiated pure water, as shown by the data below. We now present the method in more detail.

The experiment is done in two parts. In the in-line part, we expose water to sunlight. However, photons are the main background in this experiment. Therefore the in-line apparatus consisted of a bowl of distilled water, wrapped completely in aluminium foil, as shown in figure 5. The aluminium foil has the dual purpose to act as a mirror to reflect photons away, and as a thin window to allow any unknown radiation in the sunlight to penetrate into the water sample. Furthermore, it also protects the water from contamination.

This was exposed to sunlight for a period of time. Then a sample was taken, bottled and stored indoors (i.e. away from light). The glass bowl was again wrapped completely in new aluminium foil, and placed in sunlight for another period, and so on. (No allowance was made for variations with time of day or for cloud cover, which was negligible during the experiment.) In addition a control experiment with the water sample covered by

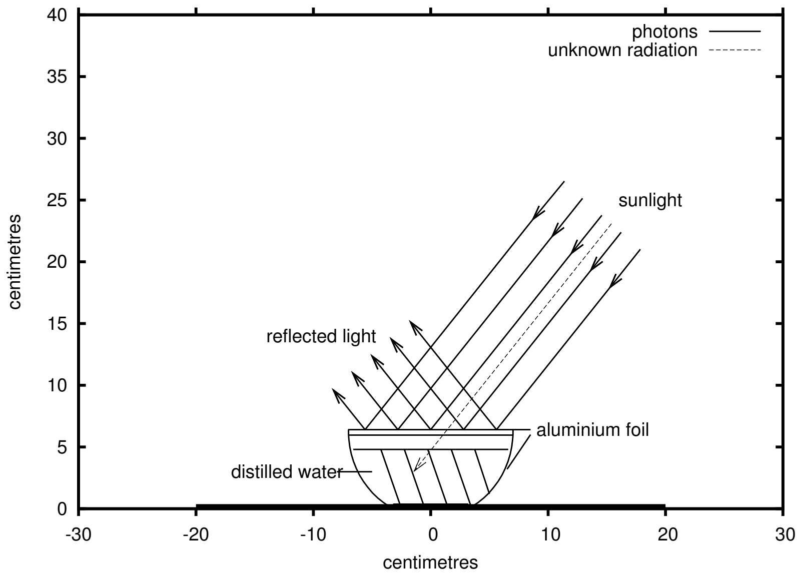

FIG. 5: The in-line detector for the main (viscosity) experiment consisted of a clean glass bowl containing distilled water, wrapped completely in 12 micron aluminium foil. This was placed outside so that sunlight shone directly onto the foil and was reflected away, whilst any unknown penetrating radiation, could pass through the foil and penetrate into the water, as shown by the dashed line. The off-line apparatus (not shown) consisted of a viscometer in a constant temperature bath, with a precision stopwatch.

Al foil, was done indoors with a halogen lamp replacing the sun. This technique meant that the signal, if any, would be caused by a new type of radiation which penetrated the aluminium foil. If nothing penetrated the foil, then there would be no effect.

Since the difference between sunlight and halogen light noted above, is small, we decided to redesign the original off-line Brownian motion experiment. In that experiment, the precision in the diffusion constant goes as $1/\sqrt{\mathrm{M}}$. So that for M = 700 measurements gives a precision of about 4%, whereas the sunlight and halogen light data differed by 1%, which was not statistically significant. In order to detect this difference precisely, one would require x20 to x30 greater precision (i.e. x400 to x900 more data points), which was not practical. However, the diffusion constant D $= k_B T/6\pi\eta a$ where k_B is Boltzmann's constant, η is the viscosity, and a is the radius of the particle; which shows that the diffusion constant and hence entropy, are inversely proportional to the viscosity. Viscosity can be measured with a precision of about 0.1% or better (using a capillary viscometer in a constant temperature bath, with a stop watch). So we chose this method for the off-line part of the experiment.

Table 1: Results of Main Experiment: Viscosity measured 5 to 6 weeks after exposure to sunlight

Sample type	Average Viscosity cSt	Δ (signal - control) cSt	Δ/σ Number of standard deviations
Signal = Al-foil filtered solar irradiated water	1.00825 ± 0.00030*	-	-
Control 1 = non-irradiated water	1.00430 ± 0.00037	0.00395 ± 0.00048	8.3
Control 2 Accepted viscosity at 20° C	1.0038	0.00445 ± 0.00030	14.8†
Control 3 = Al-foil filtered halogen light irradiated water	1.0041 ± 0.0006	0.00415 ± 0.00067	6.2

* Average of data points from half way through the first day to the sixth day.

† This value does not allow for systematic errors, the other two do and so are more realistic.

III. RESULTS OF THE FIRST VISCOSITY EXPERIMENT

All the measurements for this first viscosity experiment were made 5 to 6 weeks after the Al-foil filtered water samples were exposed to Al-foil-filtered sunlight. The results are shown in table 1 and figure 6. The solid points show the results from the irradiated water samples plotted as a function of exposure to sunlight. We see that the viscosity of 12-micron Al-filtered-solarized water increases quite rapidly with the first few hours of exposure to sunlight. It increased from the accepted value for distilled water of 1.0038 cSt to 1.008 cSt by the end of the first day, and to 1.010 cSt by the end of the third day.

There were two types of control measurement. Firstly we made measurements on non-irradiated distilled water, to check the calibration of the instrument. The open circles in figure 6 show the results of these control measurements, and they have been plotted closest to the data point before or after which they were measured. (Unfortunately this gives the impression that they have been plotted as a function of exposure to sunlight, which is not the case.) The important point is that control measurements do not increase with time, but agree with the accepted value for the viscosity of water. The average of these control measurements is 1.00430 ± .00037 cSt, which agrees within the errors with the accepted value of 1.0038 cSt (shown by the horizontal dashed line in figure 6). The experiment is thus self-calibrating.

The control experiment was done indoors with light from a halogen lamp instead of sunlight. A bowl of distilled water was wrapped in 12 micron Al foil as before, but then exposed to a 500 watt halogen lamp at a distance of 0.8 metres, for 120.3 hours (600 lux

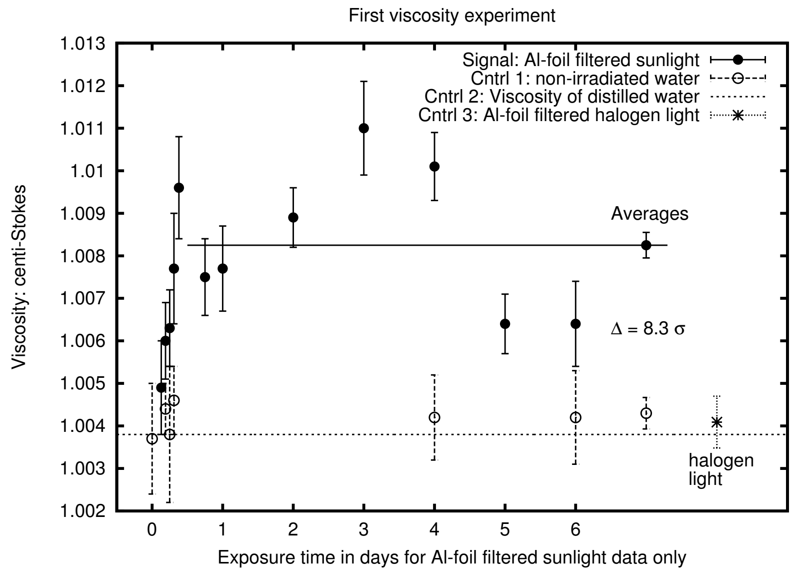

FIG. 6: Viscosity of various samples of distilled water measured off-line. The signal sample had previously been exposed to Al-foil filtered sunlight for the time indicated by the x-axis. There are 3 controls (not irradiated so the x-axis does not apply): 1) non-irradiated distilled water (shown by the signal point they were measured before or after, to check for any systematic errors); 2) the viscosity of distilled water at 20° C (1.0038 cSt) is shown by the horizontal dashed line; 3) Distilled water exposed to Al-foil filtered halogen light for 120 hours. The controls agree within the errors. The data show an effect increasing with exposure to Al-foil filtered sunlight. The signal is greater than the controls by 8.3 σ, 14.8σ and 6.2σ respectively

is equivalent to about 5 to 7 full days of October sunlight in Southern England). We then measured the viscosity of this control to be 1.0041 $\pm$ 0.0006 cSt, which is shown by the cross on the right of figure 6. It agrees with the other controls and with the accepted value for distilled water (1.0038 cSt), within the errors (δ = 0.0003 $\pm$ 0.0006 cSt). This null result confirms that we do not observe any effect from photons from a halogen lamp, and shows that the aluminium foil was opaque to photons. We also rule out UV (see appendix for details).

The data in figure 6 shows a signal which increases with exposure to sunlight whilst control measurements are approximately constant. Therefore this increase with exposure to sunlight is not an instrumental effect, but is evidence that it is caused by sunlight.[14]

The average of the values of the solar irradiated samples, from half-way through the first day to the sixth day, is 1.00825 $\pm$ 0.00030 cSt. This corresponds to an increase of 0.44$\pm$.03% over the accepted viscosity of distilled water. The small size of this increase explains why it was not detected in the Brownian motion exploratory experiment.[12]

This result differs from the value we have measured for non-irradiated distilled water (see table 1) by 0.00395 ± .00048 cSt, which is a difference of 8.3 standard deviations. Furthermore, it differs from the control sample exposed to Al-filtered halogen light by 0.00415 ± .00067 cSt, which corresponds to 6.2 standard deviations. These results show that there appears to be a new type of penetrating radiation in sunlight, which is not present in halogen light. Furthermore, the effect it produced persists for five to six weeks after the exposure to sunlight had ceased.

A. Discussion of Systematic Errors

The changes in ambient storage temperature could not have caused the effect, because the thermal history does not affect the viscosity. All the samples experienced the same temperature changes in storage and were in thermal equilibrium with their surroundings, and so the entropy should be at its maximum, according to the second law, and hence the viscosity at the minimum.

It is possible that the temperature scale was inaccurate. As noted above, the temperature of the water in the bath surrounding the viscometer was maintained at a constant value within ±0.01° C. This was monitored by three thermometers which confirmed that the temperature was maintained with this precision over the duration of the measurements. Furthermore, we measured the viscosity of non-irradiated distilled water in between the other measurements and found that they do not increase in time (as does the data). So we rule out temperature inaccuracies. The average of these measurements is within 0.05% of the accepted value for water at 20° C. So the systematic error is 0.05%.

The signal is more than ten times the systematic effects, and exceeds the halogen control by 6.2 standard deviations. So this is evidence that there is a component of radiation in sunlight which penetrates 12 micron aluminium foil.

IV. RESULTS OF REPEATING THE VISCOSITY EXPERIMENT

The result of the above experiment is unexpected, and one has to ask if there is some other explanation. One possibility is that there was some unknown chemical impurity in the distilled water such that the warmth of the sunlight would stimulate a chemical reaction and thereby somehow cause the effect.

Table 2: Results of Repeating the Main Experiment: Viscosity measured 17 to 19 weeks after exposure to sunlight

Sample type	Average Viscosity cSt	Δ (signal - control) cSt	Δ/σ Number of standard deviations
Signal = Al-foil filtered solar irradiated water	$1.0069 \pm 0.00037^*$	-	-
Control 1 = non-irradiated water	1.0040 ± 0.00037	0.0029 ± 0.00052	5.6
Control 2 Accepted viscosity at 20° C	1.0038	0.0031 ± 0.00037	$8.4^\dagger$
Control 3 = Al-foil filtered halogen light irradiated water	1.0041 ± 0.0006	0.0028 ± 0.00070	4.0

* Average increase.

† Systematic errors are not included in this value. The other two are more realistic.

So we repeated the experiment 12 months later, when the solar heating would be approximately the same, and made measurements of the temperature changes. We have used the same techniques as the first viscosity experiment. Furthermore, we had an independent laboratory measure the purity of the water both before and after the experiment to see if they could detect any impurities. Both were negligible, as shown below.

We used distilled water.[15] The residue on evaporation of this water before the experiment was determined to be < 1 ppm.[16] As before, the water was placed in a clean glass bowl (which had never contained anything other than pure water), immediately wrapped in 12 micron aluminium foil and placed in the sunlight for a specific period. It was then brought into the laboratory, some of the water bottled, the bowl re-wrapped with new foil and placed in the sunlight for additional exposure. This process was repeated for each exposure. The bottled samples (15ml) were then stored at room temperature in a cardboard box with partitions, as before.

During this second experiment we also made measurements of the temperature of the water inside the detector (i.e. the bowl wrapped in Al foil) when exposed to sunlight, that of the air in the shade near by, and that of water in a bowl open to sunlight. The data showed that the wrapped bowl was up to about 3° C warmer than the temperature in the shade, whilst the open bowl was up to about 7° C warmer than the shade, confirming that the aluminium foil reflected away much of the heat from the sun. (This experiment was not designed to determine the energy flux in this new type of radiation. However, these results suggest that there is more energy in the solar photons than in this new type of radiation, because the increase in temperature of the open bowl was more than twice

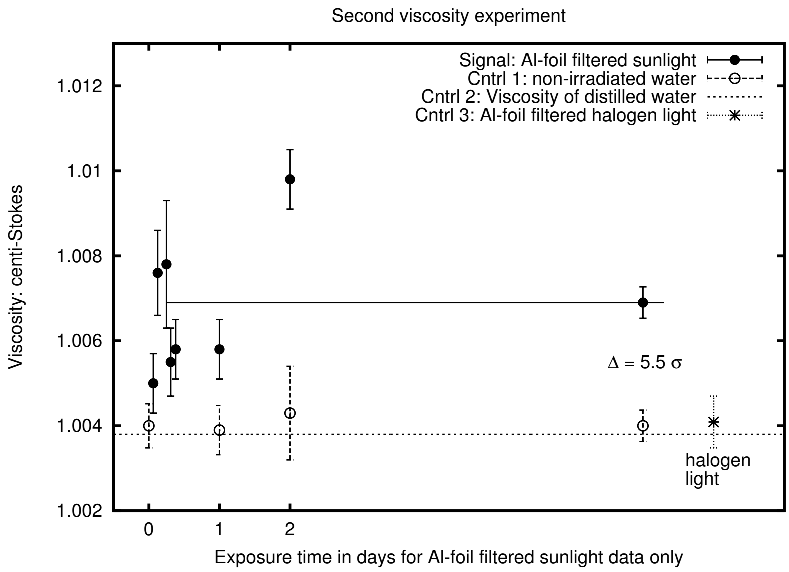

FIG. 7: Repeat of the viscosity experiment to determine the effect of aluminium-foil filtered sunlight on distilled water. The sun only lasted two days and so the number of data points is limited. The average of the right-hand five data points exceeds that of the three controls by 5.6 σ, 8.4 σ, and 4.0 σ respectively. These results confirm the previous experiment and show that the effect is reproducible.

that of the bowl wrapped in Al foil.)

We also made temperature measurements on the apparatus for the control experiment, which was done indoors using a 500 watt halogen lamp suspended 0.8 metres above two bowls as before (0.9 m above the surface supporting the bowls). One bowl was wrapped in aluminium foil and experienced a temperature increase of 3° C, whilst the open bowl was 4° C warmer than the surrounding shaded area. Thus the halogen lamp gave a similar temperature increase as the sun.

Lack of sunlight brought this second experiment to an end after only two days. After the in-line part of the experiment was completed, the last sample of exposed water (which had been wrapped in aluminium foil seven times and exposed to periods of sunlight totalling two days), was tested for impurities. The residue on evaporation for this last sample was also $<$ 1 ppm.[16] This showed that the water had not been contaminated significantly by any substances during the experiment, which confirms that the aluminium foil protected the water from impurities.

The small amount of heating, the lack of evidence for any impurities, and the fact that the halogen lamp control experiment gave a null result, even though the heating was the

Table 3: Combined Results of the two Viscosity Experiments

Sample type	Av Viscosity cSt	Diff Const D* μm^2/sec	ΔD(sig-cntrl) μm^2/sec	$\Delta D/\sigma$ std dev	Entropy S $k_B = 1$	ΔS(sig-cntrl) $k_B = 1$	ΔS %
Sig = Al-foil solar irradiated	1.0077 $\pm$ 0.00023†	.90024 $\pm$ .000206	-	-	2.8649 $\pm$0.00011	-	-
Cntrl 1 = non-irradiated	1.00415 $\pm$ 0.00026	.90342 $\pm$ .000234	-0.00318 $\pm$ 0.000311	10.2	2.8667 $\pm$0.00013	-0.001763 $\pm$0.00017	-0.062 $\pm$0.006%
Cntrl 2 Accepted viscosity at 20° C	1.0038	0.9037	-0.00346 $\pm$ 0.00021	16.5‡	2.8669	-0.001918 $\pm$0.00011	-
Cntrl 3 = Al-foil halogen light	1.0041 $\pm$ 0.0006	.90347 $\pm$ .000540	-0.00323 $\pm$ 0.000578	5.6	2.8667 $\pm$0.00030	-0.001791 $\pm$0.00032	-0.062 $\pm$0.011%

* a = 0.237 microns.

† Average increase.

‡ Systematic errors not included.

same as that due to sunlight (3° C), shows that the effect is not due to heating or to impurities.

Viscosity measurements were performed on these samples from the second experiment, 17 to 19 weeks after exposure to sunlight, using the same apparatus as before. The results are shown in figure 7. There are fewer data points than in the first experiment because there were only two days of sunlight. As a result the increase in viscosity does not reach its maximum value at three days, and the average value is somewhat less.

Nevertheless figure 7 shows that the effect increases with increasing exposure to sunlight during the first two days, as observed before. The results are presented in table 2, which shows that just two days of exposure to aluminium-filtered sunlight causes the viscosity to increase by 0.0029 $\pm$ .00052 cSt, which is by 5.6 standard deviations greater than the value obtained from control samples of distilled water. Furthermore, it is 4.0 standard deviations greater than the value obtained from the control experiment using a halogen lamp. Therefore the effect is due to some component of sunlight itself which has penetrated the aluminium foil. Furthermore, the effect persists for more than 17 weeks after exposure to sunlight, with little or no attenuation between 5 and 17 weeks (cf figures 6 and 7).

We conclude that this second experiment confirms the first and shows that the result is reproducible.

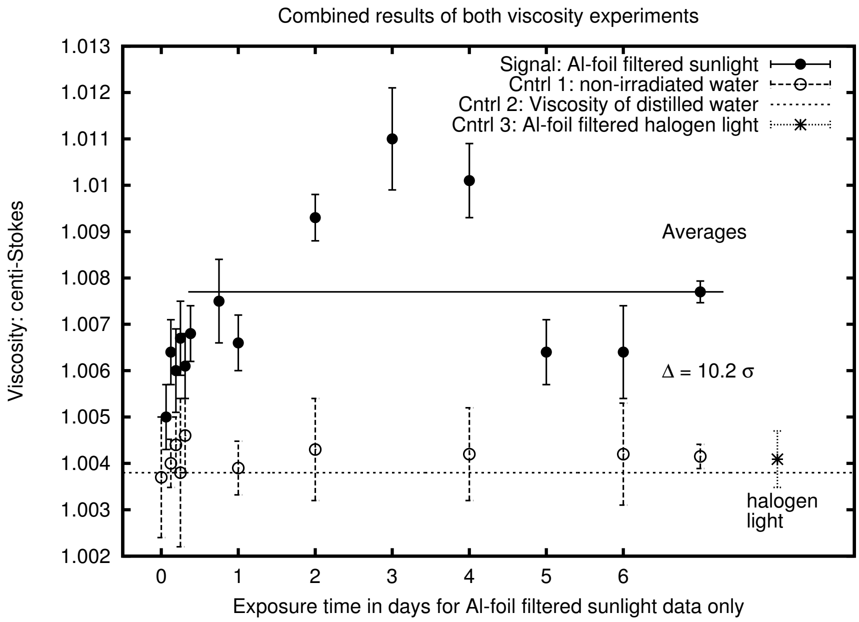

FIG. 8: Average of the results of the two viscosity experiments to determine the effects of aluminium-foil filtered sunlight on distilled water. The data show an increase with exposure to sunlight which suggests something in the sunlight is penetrating the aluminium foil. The average of the right-hand 9 data points is 1.0077 ± 0.00023 cSt, and the average of the controls is 1.00415 ± .00026, which gives a difference Δ of 10.2 standard deviations. The data exceeds the other two controls by 16.9 σ and 5.6 σ respectively.

A. Combined Results

The averages of the data points from these two experiments are shown in figure 8 and the combined results in table 3. The viscosity increases during the first three days of exposure to Al-foil filtered sunlight, and then levels off, possibly declining somewhat. The average value of the right-hand nine viscosity data points is 1.0077 ± .00023 cSt, and the average value of non-irradiated distilled water controls is 1.00415 ± .00026 cSt. So the signal is 10.2 standard deviations greater than these controls. The diffusion constant calculated from the solar signal is $D_s = 0.90024 \pm 0.000206$ μm^2/sec, and for the non-irradiated controls is $D_c = 0.90342 \pm 0.000234$ μm^2/sec, which is a decrease of 10.2 σ. The entropy values calculated from the Fokker-Planck equation in the previous paper are given in table 3, also show the decrease, which is statistically significant.

The non-irradiated controls, when compared with the internationally accepted viscosity of distilled water at 20° C (1.0038 cSt), correspond to a systematic error of 0.035%.

The signal is 10.1 times greater than this, and so the systematic errors, which are included in these results, are negligible. Furthermore, the signal is ΔV = 0.0036 $\pm$ .00065 cSt greater (δ = -0.00323 $\pm$ 0.00058 μm^2/sec less) than the null result from the halogen light control, which corresponds to 5.6 standard deviations.

B. Conclusions: Viscosity Experiments

We have observed an increase in viscosity of water exposed to aluminium-foil-filtered sunlight, which increases with exposure to sunlight to a maximum after three days. This increase in viscosity was reproduced in a second experiment. This increase corresponds to a decrease in the diffusion constant and hence the entropy, as shown in table 3. This differential decrease in the diffusion constant of δ = -0.003 $\pm$ .0003 is less than that found by the earlier experiment of -0.01 $\pm$ .029 μm^2/sec,[12] which explains why it was not observed in the first experiment. This effect was not observed when the sunlight was replaced by light from a halogen lamp in the control experiment. This null result shows that the Al-foil is opaque to photons, and therefore we rule out visible photons. Aluminium foil is a good reflector of UV and tests showed it to be opaque to UV (see appendix). Therefore we rule out UV. Nor was it caused by thermal heating of dissolved substances. Nor was it an instrumental effect.

The earth's gravity and magnetic field did not produce this effect in the controls. Furthermore, the aluminium foil surrounding the water acted as a Faraday cage, so there was no electric field. Furthermore, these effects persisted for at least 5 and 17 weeks respectively. Thus we have observed a persistent isothermal entropy decrease in the absence of an external field, which is reproducible.

The combined results are at least 5.6 standard deviation less than the halogen light control, and 10.2 standard deviations less than the non-irradiated control, both of which include the systematic measurement errors. We conclude that this effect is real, and that there is a component of radiation in sunlight which has penetrated 12 micron aluminium foil and decreased the diffusion constant of water, which corresponds to a persistent lowered entropy level, contrary to the second law.

V. ANALYSIS AND CONCLUSIONS

We have presented the results of two different types of experiment: the microscope and the viscosity measurements. Both types of experiment provide evidence for a new type of radiation in sunlight.

In the microscope experiments we observed structures in the water, which persisted for at least 3 weeks, long after the few hours necessary to reach thermal equilibrium. In the viscosity experiments we detected an increase in viscosity, which corresponds to a reduction of entropy, which persisted for at least 5 and 17 weeks respectively. The evidence is that both are caused by a component of sunlight, and both are sufficiently similar and unusual (i.e. reduced entropy levels which persist) that we conclude they are the same phenomenon.

In our previous paper, we have shown that phenomena which involve reduced entropy levels *which persist*, occur in the mirror-space-time of CIGR, where there is a second time dimension which flows from the future to the past.[12] Furthermore, we have deduced in section II above, that these larger structures are in mirror space time, because of their orderly shape and visibility. For both these reasons, we conclude that these effects occur in mirror space-time, since otherwise they would violate the second law of thermodynamics.

In both types of experiment we have shown that the effect is not produced by visible photons, nor by UV light. Therefore we rule out photons, and hence the Brittin and Gamow and the photo-mirror effects, as cause of this phenomenon. Furthermore, we rule out neutrinos because their probability of interaction is too low. We also rule out alpha particles, protons and gamma rays in sunlight and cosmic rays because their fluxes at the earth's surface (100 metres above sea level) are too low. We have thus excluded the known types of radiation in sunlight.

However, there is another possibility. When the standard model is embedded in a unified theory based on superstrings or supergravity, it normally predicts the existence of a hidden sector of particles, which have only very weak interactions with known particles in the standard model. For example axions or weakly interacting sub-electron-volt particles (WISPs).[5] However, unlike matter in the mirror sector which have negative mass, these particles have a very small but positive mass. There are a number of types of experiment designed to search for these. The above viscosity experiments are similar to light-shining-through-wall (LSW) experiments, where the wall is replaced by the aluminium foil.

It is possible that an incoming photon (with positive energy) can somehow be converted into a WISP with small but positive mass,[17] which then penetrates the aluminium foil. There are then two possibilities: either the WISP interacts directly with the water, or it converts back into a photon which then interacts with the water. In the first case, when a visible photon converts into a WISP this would be in normal 4-D space-time, because of its positive mass, and so raise the entropy level, however slightly, when it interacts with the water. This is contrary to the observations and so we rule it out. In the second case, if the WISP converts back into a photon, then it could lower then entropy level by the Brittin and Gamow effect. However, such interactions would only produce of order 1 micron "structures", not the square 12 micron ones visible in figures 2 and 3. Furthermore, the control experiments using halogen light would have produced an effect by this mechanism, *but did not.* For both these reasons, we rule out this second possibility. Therefore we exclude WISPs and LSW effects.

Furthermore, if this radiation consists of any other mass-bearing particles in normal 4-D space-time, then one would expect the entropy level to increase on interaction. However, the effect we observe has the opposite sign and it persists, which is also contrary to the second law. *Therefore, the radiation which caused this effect is not in the normal sector, and so must be in mirror space-time.*

Thus we have detected a new type of radiation in sunlight, which is not like any normal radiation because it lowers entropy levels, which may explain why it has not been detected before. Furthermore, this new type of radiation is not in the primary sector, but in the hidden sector, based on mirror space-time, which supports persistent reduced entropy levels. Therefore this is additional evidence for the second sector of a new type of unified theory.

A. Discussion

In our previous paper, we have shown that the introduction of the Observer into general relativity, brings in thermodynamics. This makes it possible to link quantum mechanics and CIGR to explain small-scale, low energy phenomena, such as the photo-mirror effect. In fact we have found experimental evidence for this effect.[12] Furthermore, we have presented evidence above for this new type of radiation in sunlight, which we conclude is in the second sector, based upon mirror-space time. This is additional evidence that unification is likely to be between quantum mechanics and chronometric invariant general relativity (CIGR) developed by Zelmanov, Borissova and Rabounski.[7–9] We suggest that this new sector be called the "mirror sector".

In the previous experimental paper, we have presented evidence that photons produce spheroidal structures in water. In this paper, we have presented evidence that this new type of radiation in sunlight, produces larger geometrical structures, which are not spheroidal. This could be preliminary evidence for Einstein's program to geometrise physics.

Furthermore, if one looks carefully at figures 2 and 3, we see that these larger structures are not only an order of magnitude larger, but they are a different shape. They are not spheroidal domains which are only slightly elongated.[12] Instead these "structures" apparently produced by sunlight in figures 2 and 3 are square, possibly pyramidal. The spheroidal shapes produced by photons are compatible with being surrounded by the membrane predicted by CIGR. However, these square shapes are clearly a different phenomenon. Also the edges seem to stand out. Whatever the nature of this new radiation, it must be able to exert a force on the water molecules (or their mirror state), which maintains them in this square shape for at least 3 weeks. The persistent existence of these square structures implies the existence of a force, over 10 to 20 microns, to create and maintain them.

So this is preliminary evidence for a new force of nature in the mirror sector. When additional evidence is obtained to confirm the existence of this force, we suggest it be called the "order force", since it creates order out of chaos.

VI. ACKNOWLEDGEMENTS

We thank Val Telegdi, Jack Steinberger and Brian Josephson for helpful discussions.

Appendix**: Experimental Method** Details of the microscope technique are given in our previous paper. Details of the viscosity technique are as follows. The filter to remove photons from sunlight by reflection, was made of 12 ± 1 micron aluminium foil with its specular surface facing outwards. It was subject to several tests to determine that it was opaque to light. It was inspected for any transmission of light. This was also confirmed by the control experiment with a 500 watt halogen lamp, which gave a null result. It was then exposed to UV from a mercury lamp producing radiation at 365.4 and 253.7 nm, using fluorescent minerals (e.g. adamite from Mapimi, Mexico) as a detector. There was no sign of UV penetrating the foil as expected, since aluminium is a good reflector of UV. All tests showed that the foil was opaque, without pin-holes, and we concluded that it was a suitable filter for this experiment.

The detector itself consisted of an ultra-clean glass bowl (which had only ever held pure water) containing distilled water. The detector was wrapped completely all over with one sheet of aluminium foil. The surface of the water was 1 cm or more below the aluminium foil. The water was about 5 cms deep, decreasing a bit during the course of the experiment as samples were taken at different intervals.

The off-line viscometer was built and operated according to British Standard 188. The apparatus consisted of the viscometer in a constant temperature bath, with thermometers and a stop watch. The constant temperature bath consisted of 10 litres of purified water B.P. whose temperature was regulated by a special controller to be 20° C with a precision of ± 0.01° C.[18] The temperature was measured with three thermometers, two with a precision of ± 0.1° C and the third of ± 0.01° C. These confirmed that the temperature controller was maintaining the temperature with the precision of ± 0.01° C.

The viscometer was a glass capillary suspended level type BS/IP/MSL which is suitable for measuring the viscosity of small samples of water.[19] The device was designed so that it could be filled with the sample which could be held until it had reached thermal equilibrium, and then a measured quantity released to flow under gravity through the capillary. The time taken for this measured quantity to flow through the capillary was about 300 seconds. This was timed with a stop watch which had a precision of 0.01 seconds, so that a precision of 0.1% or better was possible.

The following modification of BS 188 was made. Between measurements of one sample and those of the next, the viscometer was washed internally with a 2 percent v/v neutracon detergent solution, rinsed 6 or 7 times with distilled water, dried in an oven at 110 to 120° C for about an hour, and allowed to cool to room temperature. This was done to minimize cross-talk between samples. It was then filled with the next sample directly from its storage bottle (which had previously been shaken), and placed in the constant-temperature water bath to reach thermal equilibrium at 20.00±.01° C. Measurements of non-irradiated distilled water were made as controls between the measurements of some samples, in order to confirm that it gave the correct value for distilled water at 20° C. British Standard 188 requires that data points which differ by more than 0.2% be rejected, and that two or more measurements should be obtained within 0.2% of each other and averaged. We typically made ten measurements of each sample, before averaging them to obtain the data points plotted in figures 6, 7 and 8.

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