I: Evidence for Phenomena Beyond 4-D Space-Time and Theory

Thereof

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The mismatch between theory, which can predict other dimensions or spaces, and experimental physics, which is currently limited to determining objective facts in four-dimensional (4-D) space-time, is examined. There may be phenomena in other dimensions/spaces, which cannot be determined completely objectively. However, if results are reproducible, then these should be considered physically real. Magnetic monopoles are an example, because several experimentalists have shown that they only exist in the presence of intense illumination and so are not objective. Mikhailov made repeated measurements and determined that the monopole charge is quantized ($g = ng_D, n=1-5$); ($\bar{g} = (0.99 \pm 0.05)g_D$). We conclude Dirac monopoles exist, not in 4-D, but in another space-time. In the second part we bring together two theories to explain how light can switch (via the Brittin and Gamow effect) into another space (predicted by chronometric invariant general relativity: CIGR) to reveal phenomena there. Light lowers the entropy level and so reverses the arrow of time into the mirror world of CIGR, where time flows from the future to the past, and reveals monopoles there. We call this the photo-mirror effect. This explains the infinite length of Dirac’s string. These results are evidence for unification.

Keywords: experimental method; Dirac magnetic monopoles; intense illumination; mirror space-time; photo-mirror effect; Brittin and Gamow; Chronometric invariants

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I. INTRODUCTION

The paper is within the framework of the low energy frontier of particle physics, albeit with a new approach. A review of this field is given in the following reference. [1] The historical backgrounds of the other sections, where they exist, are given in each section. In the case of the mismatch between the methods of theory and experiment, the author knows of none which are relevant. In the case of magnetic monopoles, there are two histories: that of the searches for objective monopoles, which is given in the surveys of the same; and that of the more subjective monopoles which exist only when illuminated, which we present in more detail below.

We begin by examining some of the assumptions of physics. Physics is based on reason (usually defined mathematically) and fact (usually determined by controlled experiment). There are two problems with facts determined by controlled experiment. Firstly, if one relies upon objective facts only, this assumes that the Universe can be reduced to objective facts, or at least if there are any subjective or non-objective aspects, they can be ignored. There is no proof of this, and it could lead to an infinite regression. (For example, if the Universe is made from some fundamental objective substance $S_A$, then what is this made of? Either it is something subjective, or it is another objective substance $S_B$, and so on.)

Secondly, there is an imbalance here because a theoretician can define a theory in multiple dimensions (e.g. string theory) whilst an experimentalist can currently only do controlled experiments in four-dimensional (4-D) space-time. If one wants to make measurements in other spaces or dimensions, then assuming it is possible, there is inevitably some reduction in control and/or objectivity. Currently such results tend to be rejected because they are not completely objective (i.e. not in 4-D space time). So we make the assumption that there maybe phenomena which cannot be detected completely objectively, but nevertheless they should be considered physically real if the results can be reproduced. We have examined the literature and find that magnetic monopoles are an example of this.

II. MAGNETIC MONOPOLES

We present experimental evidence from the literature, for real ($\nabla \cdot B \neq 0$) magnetic monopoles, as opposed to the pseudo-monopoles ($\nabla \cdot H \neq 0$) sometimes observed in spin
ices or other solid-state phenomena.

Over the last 70 years there have been numerous searches for real magnetic monopoles with mostly negative results. Compilations of these searches conclude that there is no reproducible evidence for magnetic monopoles.\[2, 3\] But there is an assumption behind this conclusion, namely that magnetic monopoles must be particles which can be detected objectively in 4-D space-time. The problem is that in Dirac’s theory there is a line connecting two monopoles which has to be *infinitely long*, and yet the universe is finite.\[4\] This infinite length of the Dirac string is normally explained away as an artefact of the calculation. However, if we take this seriously, then it implies that both monopoles are outside 4-D space-time. (In principle one could be inside, the other outside, but that would require preferential treatment for one monopole over another, which the theory does not provide. So we reject this.) In which case it will not be possible to detect them objectively by the normal methods of experimental physics. Therefore the conclusion of the above compilations is not strictly correct. It should read “there is no reproducible evidence for magnetic monopoles in 4-D space-time”. If we take the infinite length of the Dirac string seriously, then this is not evidence for or against magnetic monopoles because they are not predicted to be in 4-D space-time.

Furthermore, if a phenomenon is not objective, then it is currently rejected by physicists as not being physically real. Therefore, the above monopole surveys usually omit most, if not all, of the references to the following experiments which provide reproducible evidence for magnetic monopoles, but of a subjective nature. They are subjective because *these monopoles are only visible under intense illumination*. When the intense illumination is turned off, they disappear, in the sense that the particle being observed ceases to move as a monopole, and moves as a neutral particle or dipole. Thus these monopoles do not seem to exist in their own right. However, these results are reproducible, and so we argue they are physically real. Here is a summary of the published evidence.

### A. Ehrenhaft

Ehrenhaft first reported observation of single magnetic charges, which were only detectable under intense illumination, in 1930,\[5\] before Dirac’s paper in 1931.\[4\] However, Dirac did not recognise Ehrenhaft’s results.\[6, 7\] (Not only were Ehrenhaft’s results subjec-
tive, but they were obtained at very low energies. So Dirac rejected them. We discuss this below.) Curiously more physicists know of Dirac’s theory than Ehrenhaft’s experiments. The essence of Ehrenhaft’s observations is that when microparticles of ferromagnetic substances (such as iron, nickel or cobalt) are suspended in a gas atmosphere and subjected simultaneously to a uniform magnetic field and to intense illumination by light, they move as objects carrying single magnetic charges. If the magnetic field $H$ is reversed, then the direction of motion of the single magnetic charges are reversed (magnetic dipoles would not do this). This effect was confirmed by Benedikt and Leng.\[8\]

Ehrenhaft did a number of experiments,\[9\] and when he did not get the recognition he felt he deserved, he made more extreme claims, such as that “light magnetises matter”.\[10\] He was convinced that he had discovered free magnetic charges and should get the kind of recognition of someone such as Ampère or Faraday. He claimed he had created a magnetic current by causing the monopoles to move.\[11\] He also claimed to have discovered “magnetolysis”, being the magnetic equivalent of electrolysis.\[12\] Many physicists were unconvinced that “light makes magnetism”, found the effect not objectively real, and so tended to ridicule the results.\[13\] Einstein took the observations seriously, but wanted a better explanation.\[14\]

Kemple made a review of experimental searches for monopoles up to 1961, including not only the work of Ehrenhaft, but also by his contemporaries. He noted that other experimenters could not reproduce some of these results, and therefore concluded that this work is not evidence for magnetic monopoles.\[15\] However, this is not strictly correct, because even though some of the experiments may not have been confirmed, the basic observation of magnetic monopoles under intense illumination, was confirmed by Benedikt and Leng.\[8\]

B. Mikhailov

There the matter might have rested, had it not been that Mikhailov repeated Ehrenhaft’s magnetic charge experiment with better technique, and confirmed the result.\[16\]-\[18\] In his first experiment, he used iron microparticles suspended in an atmosphere of argon, illuminated by a laser with power up to 1 kW/cm$^2$, and in the presence of crossed uniform electric and magnetic fields, which were switched by a square wave-form with a frequency of a few Hertz. The particles were observed with a microscope, and moved under the influence of the crossed electric and magnetic fields ($E$ and $H$). By observing their motion, one could
select the signs of the electric and magnetic charges of the particles being observed.

The observed microparticles had a mass $M \leq 10^{-14}$ gram and size $r \leq 10^{-5}$ cm, and their motion was governed by Stokes’ law. By making measurements on particles carrying both an electric and a magnetic charge, it was possible to measure the ratio $g/q$ independently of the Stokes’ coefficient, and hence of the size of the particle. From observations of 1200 such particles, Mikhailov found that the magnetic charge is quantized. But this initial value of $g$ disagreed with Dirac’s prediction. However, Akers pointed out that Mikhailov had ignored components of the particle’s velocity orthogonal to $E$ and $H$, and so this interpretation of the result could be incorrect.\[19\]

Mikhailov reanalysed his experiment and found that the magnetic charge in this experiment, is in fact the solution of a quadratic equation and so gives two possible values. One value is the one he had previously reported, the other being that predicted by Dirac. In order to distinguish between these two values, Mikhailov redesigned the experiment to remove this ambiguity and also possible surface effects.

He condensed super-saturated vapour onto solid ferromagnetic particles in a diffusion chamber, which created a smooth surface round each particle and so eliminated surface effects. These ferromagnetic particles, surrounded by fluid, were allowed to drop through a beam of light, under the force of gravity in a magnetic field $H$, which was periodically inverted. Under these conditions, particles exhibiting the magnetic charge effect, fall in a zigzag path. He observed 428 such tracks with a mean magnetic charge of $\bar{g} = (2.5^{+1.6}_{-1.3}) \times 10^{-8}$ gauss.cm$^2$, which agrees with the value predicted by Dirac of $g_D = 3.29 \times 10^{-8}$ gauss.cm$^2$ within the errors. In this way, Mikhailov showed unambiguously that he was observing Dirac “monopoles”, and furthermore, these were not due to surface effects on the particles.\[20\]

He also re-ran his previous experiment, choosing the correct root, and found that the ferromagnetic particles carried from 1 to 5 magnetic charges. The histogram of magnetic charges clearly shows 5 separate peaks corresponding $g = ng_D$ where $n = 1$ to 5, with the peaks being gaussian-like with some gaps in between.\[21\] This confirms that the magnetic charge is quantised, and rules out Schwinger monopoles which have twice the magnetic charge ($g_S = 2g_D$).\[22\]

He also reanalysed his previous experiments, dividing the data by $n$, and obtained a narrow bell-shaped distribution centred on $\bar{g} = (3.27 \pm 0.16) \times 10^{-8}$ gauss.cm$^2 = 0.99 \ g_D$ with an accuracy of $\pm 5\%$.\[23\] Therefore, by these ingenious experiments, Mikhailov has
observed Dirac monopoles, \textit{but only when illuminated by light}. There is no satisfactory explanation for this.

\textbf{C. Discussion}

In the main, these subjective results have been rejected or ignored. However they are reproducible, because several experimentalists have observed more than one thousand single magnetic charges. Therefore these single magnetic charges \textit{should be considered a real physical phenomena}. However the objective methods of physics have failed to detect them, and there is no evidence for them in 4-D space-time, as shown above. Therefore the monopoles observed must be in another space.

Nevertheless, this is not a complete explanation. We also need a theory which predicts the existence of this second space, together with a mechanism which enables light to switch space-time into this second space. We now present such a combined theory.

\section*{III. SUNLIGHT SHINING ON THE EARTH'S SURFACE}

We start with an existing theory of an unexpected property of light which does the switching, and then introduce a version of general relativity which predicts a more complex structure to space-time. The basic idea is that light switches the direction of the flow of time into that of another space-time.

\textbf{A. Brittin and Gamow’s Theory}

In a simple theory, Brittin and Gamow have suggested that sunlight shining on the earth, pumps entropy out into space, thereby allowing negentropy to accumulate on the earth’s surface. The sun’s radiation consists of high temperature photons coming from the surface at \( T_s \simeq 5,900^\circ \text{K} \), which spreads out in space and becomes diluted. By the time it reaches the earth’s surface, it’s energy density corresponds to a temperature of the earth \( T_e \simeq 300^\circ \text{K} \), so these photons are not in thermodynamic equilibrium.

Brittin and Gamow use the quantum theory of radiation to show that the net entropy
change when sunlight interacts with the earth’s surface is:

$$\Delta S = \Delta S_s - \Delta S_e = \frac{4}{3} \Delta Q \left( \frac{1}{T_s} - \frac{1}{T_e} \right)$$

(1)

which is negative because $T_s > T_e$. So the entropy at the earth’s surface is reduced. They reason that this is not contrary to the second law of thermodynamics because it is simply due to the temperature gradient $T_s > T_e > T_{\text{space}}$, but see below. (Note this effect is not limited to sunlight, but also occurs with light from an artificial source. For example, light from a halogen lamp can also lower entropy levels, because $T_h \simeq 3000^\circ K$ and so a temperature gradient similar to sunlight, applies $T_h > T_e > T_{\text{space}}$.) However, there is a hidden complication, whether the source is natural or artificial.

This mechanism enables negative entropy to build up on the earth’s surface, provided it can be stored. In the case of sunlight, they calculate that photosynthesis has an efficiency of about 10% for capturing this negative entropy. Brittin and Gamow suggest that this is the source of order for the food chain, which Schrödinger proposed to be a current of negative entropy.\cite{25, 26} As a result, this is not a purely physical theory because it relies upon plants (and hence biochemistry) to capture the negentropy. (This may explain why there is not much published by physicists about this.) This theory would be more interesting to physics if there is a physical mechanism to store the negentropy produced.

**B. Discussion of Brittin and Gamow Effect**

There is also a contradiction in this theory. On the one hand, it predicts that solar photons lower the entropy level on the earth’s surface, and this logically follows from the temperature gradient. However the reduction in entropy level of a closed system is contrary to the second law of thermodynamics. In order to remove this contradiction, we conclude that there is something missing from Brittin and Gamow’s theory, or the second law of thermodynamics, or both.

In classical thermodynamics, the entropy increases with the arrow of time.\cite{27} Quite a lot has been written about *time* in recent decades, but mainly from a theoretical or philosophical point of view.\cite{28, 30} However, we are concerned with a very specific problem. What happens to time when a solar photon interacts with the earth’s surface, thereby lowering its entropy level? Is the direction of time reversed (e.g. locally), either momentarily
or more persistently, when the photon lowers the entropy level? We conclude that it logically
must, because otherwise Eddington’s arrow of time would be violated, and the second law
of thermodynamics also. Therefore what is missing from Brittin and Gamow’s theory, is a
theory of space-time with a second time dimension which flows from the future to the past.
(Experimental support for this reasoning is given in the following reference.[31])

There are several theories with two time dimensions. For example, 11-dimensional ex-
tended supersymmetry in M-theory is really a 12-dimensional SUSY with an SO(10,2)
symmetry.[32–35] F-theory in twelve dimensions (12-D) is similar.[36] But these second time
dimensions are compactified. Köhn has taken a different approach and added a second time
dimension to the Einstein-Friedmann equations.[37] This enables him to solve the cosmo-
logical constant problem, but the second time dimension, whilst not compactified, is on the
spacial scale of the Planck length. Bars and his colleagues have done the most work in this
area of two-time physics.[38] However, neither of his two time dimensions help explain the
phenomena which interest us. Furthermore, there does not appear to be any GUT which
predicts a second time dimension which flows from the future to the past.

There is, however, a version of the theory of general relativity which predicts this. This
extension is not well known, and so we present a summary of it below.

IV. GENERAL RELATIVITY: CHRONOMETRIC INVARIANTS

One important development in general relativity was the correct introduction of the Ob-
server by Abraham Zelmanov. Einstein’s original theory was of space-time and matter-fields,
and did not include the Observer. However, each Observer has a specific reference frame
where he or she is located, for example, at particular coordinates on the earth with its own
gravitational field, which is also rotating. As a result, what is actually observed there is not
well-defined by the original theory. The values of quantities predicted by general relativity
are in effect theoretical, because in practice they are not corrected for the Observer’s refer-
ence frame. So without the Observer, general relativity is incomplete. The case for including
the Observer is thus compelling. This problem was recognised and worked on in the 1930s
by Landau and others. Some progress was made to solve it for specific cases by Landau
and Lifshitz.[39] What was required was a strict mathematical formalism to calculate the
observable values for any tensor quantity. Zelmanov correctly developed this general theory
in 1944. However, it was not published until 1956.\[40,41\] The mathematical details of the theory are given in the references. We just present a short summary of the main points here.

Physically observable quantities are obtained by projecting four-dimensional quantities onto the time lines and three-dimensional space of the Observer’s reference frame. *Physically observable quantities must be invariant with respect to transformations of time,* and so they are *chronometrically invariant quantities.* Thus the general case of the Observer was incorporated into general relativity in Russia in the era of the Soviet Union. Cattaneo later obtained similar results.\[42–44\]

Borissova and Rabounski have developed this theory further. They find that the chronometric invariant equations of motion for mass-bearing particles into the past and into the future are *asymmetric in time.* They conclude there is a fundamental asymmetry of the directions of time in the in-homogeneous space-time of general relativity. They hold up a "mirror" to time and find that it does not reflect completely, and that there is a different world "beyond the mirror". The four-dimensional momentum vector for a particle with non-zero rest mass, $m_0$ is:

$$P^\alpha = m_0 \frac{dx^\alpha}{ds}, \quad P_\alpha P^\alpha = 1, \quad \alpha = 0, 1, 2, 3. \quad (2)$$

When a vector (or tensor) is projected onto the time line and spacial section of an observer, these projections give the physically observable quantities for that observer.\[40\] Using the properly observable time interval ($d\tau = \sqrt{g_{00}} \, dt + \frac{g_{0i}}{c\sqrt{g_{00}}} \, dx^i$),\[39,40\] the above four-dimensional momentum vector has two projections onto the time line, namely:\[45,46\]

$$\frac{P_0}{\sqrt{g_{00}}} = \pm m, \quad \text{where } m = \frac{m_0}{\sqrt{1 - v^2/c^2}} \quad (3)$$

### Table 1: Summary of Spacial Properties of Chronometric Invariant General Relativity

| mass | Particles                        | Energies | Class of motion                | Area       | Time         | Entropy       |
|------|----------------------------------|----------|--------------------------------|------------|--------------|---------------|
| $m > 0$ | massive particles               | $E > 0$  | move at sub-light speeds       | our world  | $dt > 0$     | $\Delta S > 0$ |
| $m = 0$ | massless particles (photons)     | $E > 0$  | move at speed of light         | our world  |              |               |
| $m = 0$ | light-like vortices              | $E = 0$  | moving and rotating at speed of light | the membrane | $dt = 0$     |               |
| $m = 0$ | massless particles (photons)     | $E < 0$  | move at speed of light         | the mirror world |              |               |
| $m < 0$ | massive particles               | $E < 0$  | move at sub-light speeds       | the mirror world | $dt < 0$     | $\Delta S < 0$ |
whereas it has only one spacial projection:

\[ P^i = \frac{m}{c} v^i = \frac{1}{c} p^i \quad \text{where} \quad v^i = \frac{dx^i}{d\tau}, \quad i = 1, 2, 3. \] (4)

where \( p_i \) is the three-dimensional observable momentum. They conclude that any massive particle, having two time projections, exists in two observable states, entangled to each other: the positive mass state is in our world, while the negatively charged mass state is in the mirror world. Using the techniques of chronometric invariants, they find that there are three separate areas: our world (i.e. normal space-time), the mirror world, and a membrane which separates the two.\[45\] A summary of their results is shown in table 1.\[47\]

The flow of time is well defined mathematically in general relativity. It is determined by the sign of the derivative of the coordinate time \( t \) with respect to the proper time \( (dt/d\tau) \). Using \( w = c^2(1 - \sqrt{g_{00}}) \) and \( \nu_i = -c \frac{g_{0i}}{\sqrt{g_{00}}} \) Borissova and Rabounski derive the following quadratic equation:

\[
\left(\frac{dt}{d\tau}\right)^2 - \frac{2\nu_i v^i}{c^2 (1 - \frac{w}{c^2})} \frac{dt}{d\tau} + \frac{1}{(1 - \frac{w}{c^2})^2} \left( \frac{1}{c^4} \nu_i \nu_k v^i v^k - 1 \right) = 0
\] (5)

the two roots of which are:\[46\]

\[
\left(\frac{dt}{d\tau}\right)_{1,2} = \frac{1}{1 - \frac{w}{c^2}} \left( \frac{1}{c^2} \nu_i v^i \pm 1 \right)
\] (6)

This equation has three possible solutions \( dt/d\tau > 0, dt/d\tau < 0, \) and \( dt/d\tau = 0 \). In our world, \( dt/d\tau > 0 \) and time flows from the past to the future. In the mirror world \( dt/d\tau < 0 \) and so time flows in the opposite direction. Between the two is a membrane where time has stopped \( dt/d\tau = 0 \). Thus the two worlds are separate, because of the membrane, but equal. So that to an Observer (in our world), time in the mirror world flows from the future to the past.

The membrane which separates the two worlds, has its own unique three-fold structure. On our world side and the mirror world side, are streams of light-like particles (photons), moving at the speed of light, but with opposite energies and frequencies. Between the two in the membrane, time has stopped because \( dt/d\tau = 0 \), and so this region is a void which is purely spacial. However, in this void there are light-like vortices, previously unknown, which have zero relativistic masses (unlike photons which, although massless, have non-zero relativistic masses). These light-like vortices move and rotate at the speed of light, but have no energy because for them time has stopped - they are purely spacial.
Any mass-bearing particle has two time projections, one in each world, and exists in two observable states. Each particle is in effect a four dimensional dipole object, which exists in two states: in our world with positive mass and energy; in the mirror world with negative mass and energy (NB this negative mass state is not anti-matter, because the inertial mass of anti-matter is positive). However, they cannot “annihilate“ or rather ”nullify“ (since the net energy is zero) because they are separated by the membrane. Furthermore our world and the mirror world have the same background space, and *the three-dimensional momentum remains positive in both sectors*. More details are given in the references above.

We refer to this theory of physically observable quantities, as ”chronometric invariant General Relativity“ or CIGR.

### A. Extensions of CIGR and Thermodynamics

Despite its history, chronometric invariants seems to be almost unknown. One possible explanation is the timing of its publication (1956 and 1958), after Einstein’s death and before major observational discoveries in astronomy (X-ray sources in 1962; quasars in 1963; the 3° K background in 1965; pulsars in 1967; and the black hole Cygnus X-1 in 1972). As a result, general relativity has been widely applied to these large-scale, extreme phenomena, which makes it difficult to unify it with the small-scale phenomena of quantum mechanics. This has been further reinforced by the discovery of gravitational waves.

We note that in CIGR, our world and the mirror world have the same background space. We make the following deductions from this.

1. Time in the mirror world is a macroscopic time dimension.

Furthermore, the two worlds or sectors in this theory are separated by the triple-layer membrane, with time flowing in opposite directions on either side.

2. Photons are trapped on either side of this membrane because there is no time dimension in the void in between. Therefore photons cannot traverse this membrane, and so it will reflect or scatter light like a mirror.

3. The space-time structure of this theory has thermodynamic consequences. Given that entropy in our world increases with our time, it seems reasonable to assume that entropy in the mirror world also increases with that arrow of time. However, mirror-world time flows from our future to the past, so it logically follows that an Observer in our world would
see the entropy in the mirror world to be constant or decrease with our time. Thus in the chronometrically invariant form of general relativity, the second law of thermodynamics, in its present form, only applies in our world. When the mirror sector is included, the second law would appear to be dual, with respect to our time.

V. PHOTO MIRROR HYPOTHESIS

We now combine together Brittin and Gamow’s theory with CIGR. We make the hypothesis that under certain circumstances, light can switch space-time into the mirror world state, by means of the Brittin and Gamow effect, because this reduces the entropy level which reverses the direction of time. We predict this will occur locally where each photon interacts. This reversal could be momentary or persistent depending on the phenomenon being observed.

Note that this is a low energy effect for two reasons. Firstly according to CIGR, any massive particle exists in a 4-dimensional dipole state with positive mass and energy in our world and negative mass and energy in the mirror world. Since the mirror world state already exists, it does not require any energy to produce it. All that is required is the reversal of the direction of time to reveal it. Secondly the reversal of the flow of time simply requires photons with energies of a few electron volts to lower the entropy level according to the Brittin and Gamow effect (equation 1).

The reader may wonder why, if photons can switch matter into the mirror world state, it has not been observed before. Firstly, the effect is subtle and occurs at very low energies. Secondly, physicists are so convinced that the second law of thermodynamics is absolute, that few have looked for the creation of order. Thirdly, this effect has been observed in experiments using light to reveal magnetic charges in mirror space-time, but these have been rejected or ignored, because they are at low energies and subjective (i.e. not objective).

A. Explanation of Magnetic Monopoles

In his second paper on monopoles, Dirac states that Ehrenhaft’s observation of magnetic poles ”is not a confirmation of the present theory, since Ehrenhaft does not use high energies“.[6] It seems that Dirac was convinced that magnetic monopoles would only be ob-
served at high energies because of the very strong force between pairs of monopoles. (High energies also imply objectiveness.) However, in this paper Dirac also concludes that not only may two monopoles be connected by an infinite string, but alternatively a monopole may be connected to a string extending to infinity. If he had taken this more seriously, he would have concluded that the monopoles could be in a separate space, and so not necessarily a high energy phenomenon.

We have concluded above that under intense illumination, observation of magnetic monopoles is reproducible, so they are physically real, but do not appear to exist in 4-D space-time. We suggest that photons of the intense illumination switch the direction of time in the space-time containing the ferromagnetic particles (via the Brittin and Gamow effect), into the mirror world space-time, where the magnetic monopoles exist and are observed. Therefore the intense illumination does not "make magnetism" as Ehrenhaft claimed, but "reveals magnetic monopoles" in this other space-time.

The microparticles measured by Mikhailov were composite ($M \leq 10^{-14}$ gram), so the monopoles could be composite pseudo-particles (instantons). However, the charge of these pseudo-particles would not then be quantised, and certainly not with the monopole charge of Dirac which Mikhailov observed.\[23\]

Furthermore, Dirac’s theory provides us with a topological picture of this phenomenon. If the monopoles are in one space, and the dipole is in another, then the Dirac string between a monopole and the corresponding pole of the dipole, is naturally infinitely long. Therefore observation of monopoles in mirror space-time and magnetic dipoles in normal 4-D space-time, provides a natural physical explanation of the infinite length of the Dirac string, and so it confirms this aspect of his theory. In view of these results, Ehrenhaft, Benedikt and Leng, and Mikhailov really did observe Dirac monopoles at these very low energies.

VI. PREDICTIONS

By incorporating the Observer into general relativity, CIGR includes thermodynamics and makes predictions about smaller scale phenomena (as opposed to black holes), such as low entropy states in the mirror world with its second time dimension. We predict that this inclusion of thermodynamics makes it possible to unify CIGR with quantum mechanics.

We predict that mirror space-time will became the basis for the hidden sector predicted
by most grand unified theories. We predict that any new force(s) in this mirror sector will lower entropy levels, since mirror time flows from the future to the past.

We predict that phenomena in this second sector will be different from those in the normal sector currently studied by high energy physics. For example, they will tend to be subjective, collective (low entropy), low energy phenomena, rather than objective, separate particles (high entropy) currently observed at high energies. Therefore experimental methods to detect phenomena in the mirror sector, will be different from those currently used in high energy physics.

VII. CONCLUSIONS

We have presented reproducible evidence for magnetic monopoles which appear to exist outside 4-D space-time. We conclude that the current method of experimental physics is flawed, because it limits observations to 4-D space time. Phenomena beyond 4-D space-time currently are rejected. The solution is to relax the criterion of objectivity, and recognise reproducible phenomena as being physically real. This is especially the case if there is a theory for that phenomenon.

On this basis, magnetic monopoles have been observed which have the charge of Dirac monopoles \( g = (3.27 \pm 0.16) \times 10^{-8} \text{ gauss.cm}^2 = 0.99 \ g_D \) with an accuracy of \( \pm 5\% \). Furthermore, this charge is quantised \( (g = n g_D \text{ with } n = 1 \text{ to } 5) \). Therefore Dirac monopoles have been observed. However, whilst this phenomenon is not objective, and therefore outside 4-D space-time, nevertheless it is reproducible and therefore physically real.

We then combine the Brittin and Gamow effect and CIGR to make the photo-mirror hypothesis, namely that light lowers the entropy level and reverses the direction of time, thereby switching matter into mirror space-time of CIGR, where time flows from the future to the past. Therefore the photons of the intense illumination switch the ferromagnetic particles, via the photo-mirror hypothesis, into the mirror world space-time, where the magnetic monopoles are observed. In this way, the intense illumination reveals magnetic monopoles in mirror space-time. In effect, under certain circumstances, light gives us a window into another world.

We conclude that observation of magnetic monopoles only in mirror space-time and dipoles only in normal 4-D space-time, provides a natural physical explanation for the infi-
nite length of the Dirac string, and confirms this aspect of his theory. Furthermore, this is
evidence for phenomena beyond 4-D space-time.

The author has obtained independent experimental evidence for the photo-mirror hy-
pothesis, which will be published separately.\[31, 50\] This justifies its use above to explain
the magnetic monopole data. The photo-mirror hypothesis links a quantum mechanical
effect (Brittin and Gamow) with general relativity (CIGR), which implies unification. Fur-
thermore, magnetic monopoles are predicted by many unified theories. Therefore evidence
for these phenomena suggests unification.

A. Limitations

The author is an experimentalist. The above theory (CIGR) has limitations, because it
has not yet been properly unified with quantum mechanics, nor had the standard model
embedded within it. Therefore, some of the details and predictions of CIGR may change.

VIII. ACKNOWLEDGEMENTS

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