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Towards a Predictive Model of Subtle Domain Connections to the Physical Domain Aspect of Reality: The Origins of Wave-Particle Duality, Electric-Magnetic Monopoles and the Mirror Principle

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Abstract — Humans see only a small fraction of the electromagnetic spectrum and hear only a small fraction of the sound spectrum. Perhaps we similarly perceive only a small fraction of a greater reality spectrum. We propose to quantify this concept by hypothesizing that our familiar D-space of ordinary experience and physical laws is augmented by a reciprocal R-space. It is conjectured that conjugate substances synergistically functioning in both our familiar direct four-space (D-space) and its reciprocal four-space (R-space) constitute a special eight-space representation of matter whose projection onto D-space constitutes the present base space for quantum mechanics and electromagnetism. Utilizing a Fourier transform relationship between conjugate substances functioning in these dual four-spaces, it has been possible to show that: (1) the R-space substance has negative energy and thus is a resident of the physical vacuum; (2) this R-space substance forms the pilot waves conjugate to physical particles, exhibits velocity properties faster than physical light and has a magnetic nature; (3) variation of the undulation intervals of the wave-like R-space substance controls the position, velocity, acceleration and locus of particle-like moieties in the "now" of D-space; and (4) a special inversion mirror-type relationship exists between the substances of these two spaces with Maxwell-type equations existing in each.

Keywords: dual four-spaces — magnetic monopoles — electromagnetism — superluminal velocities — negative energies — de Broglie pilotwaves

Introduction

Today, everyone knows that humans see only a small fragment of the electromagnetic (EM) spectrum and hear only a small fragment of the sound spectrum. Thus, it shouldn't seem too unreasonable to propose that, on average, humans currently perceive only a small fragment of the reality spectrum. Although many will have no problem concerning the possible existence of distinctly different bands of reality in the overall spectrum of reality, most of us, but not all of us, have difficulty with cognitively accessing bands other than the physical band.

In a previous paper [1], this author defined subtle energies as all energies beyond those associated with the four fundamental forces accepted by today's physics and proposed that they constitute energies that flow in various substructures of the vacuum. This is why they are non-observables *via* the physical senses or present-day instrumentation. Figure 1 was proposed as one example of possible subtle domain constructions one might wish to consider and explore. However, no relevant details were given as to how such a heirarchy of substructures might operate.

In a recent book [2], a full-blown qualitative description of this model and its consequences has been given while, in this series of papers, the beginnings of its quantitative foundation will be laid. In particular, here we focus largely on the physical and conjugate physical domains of Figure 1 plus their imbedding domain.

Today, conventional physical domain theories all rest on the foundations of quantum mechanics which, although having only an empirical basis, is known to work to high levels of quantitative precision even though little insight is obtained into the detailed processes involved in the various interactions. A portion of this may be due to the Kaluza-Klein representation of higher dimensions as tightly "rolled-up" cylinders at each point of distance-time four-space [3] so that they are inaccessible by our physical cognition mechanisms and we can perceive only some projection of higher-dimensional events onto our familiar four-space [2]. A portion may also be due to the fact that we do not yet understand the origins of wave-particle duality although we know that it is a key "linchpin" of quantum mechanics. To proceed to a quantitative under-

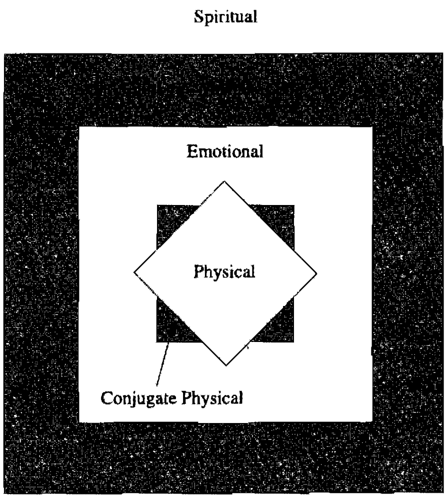


Fig. 1. A visualization of dual four-space frames (physical and conjugate physical) constituting a special eight-space imbedded in a nine-space (emotion frame) which is, in turn, imbedded in a ten-space (mind frame). All of this is imbedded in an eleven-space which is the domain of spirit.

standing of subtle domain phenomena, it seems useful and perhaps necessary to move along a path that guarantees wave-particle duality from the very outset and that is the approach taken in this paper.

It is well known that Nature generally displays properties of symmetry and this is certainly manifest in the physical presence of positive and negative electric charge monopoles. Surprisingly, although magnetism is a physical observable, it does not manifest as a monopole but only as a dipolar quality. Although science has looked long and hard for these magnetic monopoles, no satisfactory experimental evidence has been found to reveal their physical existence. However, on the theoretical side, Harmuth [4] showed that, although Maxwell's equations fail for waves of non-negligible relative frequency bandwidth propogating in a medium with non-negligible losses because of singularities encountered in the course of the calculation, the equations succeed when a magnetic current density (moving magnetic monopoles) is introduced into the equation set and then shrunk to zero after one has reached the last singularity but not before. On another front, Seiberg and Witten [5] found that in the four-dimensional quantum field theory, supersymmetry, certain key singularities could be eliminated by introducing magnetic monopoles. They were able to show that the monopoles became massless right when the equations, in the absence of magnetic monopoles, explode to infinity.

Barret [6] may have cleared up the dilemma by pointing out that the Maxwell equation guage symmetry is of the $U(1)$ form when only electric charge and electric currents are present but is of the more complex $SU(2)$ form when magnetic charges and currents are also present. $U(1)$ fields are known to have fewer local degrees of freedom than $SU(2)$ fields, and $SU(2)$ fields can be transformed into $U(1)$ fields by the process of symmetry breaking. However, after symmetry breaking only *some* topological charges are conserved; electric charge is conserved but magnetic charge is not. One can conclude from this that, when one wishes to consider phenomena wherein magnetic charge is important, one must focus on a higher level of reality, $SU(2)$, than that of the purely physical reality, $U(1)$.

Over the last two centuries, a variety of magnetic anomalies have appeared that are still not understood today. It is time that they are also taken into consideration. A partial list is the following:

(1) In the 1850s, Baron von Reichenback was studying magnetic phenomena *via* the use of sensitive human subjects as detectors [7]. His subjects observed a blue flame-like glow from the north pole of a magnet and a red flame-like glow from the south pole. These flames could pass through a building wall and displayed no tendency to unite; they could be diverted by blowing on them or by placing a solid object in their path and no heat could be detected from them. This magnetic light could be focussed by a glass lens and it could reportedly expose silver halide photographic plates [7].

(2) In terms of the psychic phenomena area of activity, professional psychics have talked repeatedly for the last ~200 years about magnetism as a major source governing and determining this class of phenomena. Electricity has not been referred to as such a source. Experimentally, it has been observed that, if one places a psychic subject in a Faraday cage, they work even better whereas, if they are placed in a magnetically shielded room, they often lose their psychic abilities.
(3) If one looks at some careful work in the dowsing area [8], one finds that dowsers are incredibly sensitive to electromagnetic energies, particularly to magnetic fields and at levels $\sim 10^{-12}$ of the Earth's field. Amazingly small perturbations in the local magnetic field appear to trigger signals in the dowser's adrenal glands. From polarized electromagnetic wave studies with dowsers, they have been shown to be especially sensitive to the magnetic component of the EM wave, especially when the magnetic component is horizontally polarized [8].
(4) From the experience on the enzyme tripsin in water [9], one notes that the enzymatic activity is enhanced in strong DC magnetic fields and also by the action of a healer's hands. This particular healer effect was equivalent to that of a 20,000 G magnet [9]. Other experiments revealed that magnet-treated water and healer-treated water exhibited a reduced surface tension by ~20% and a reduced hydrogen bonding [10]. The surface tension relaxed back to baseline in ~48 h after the removal of the magnet.
(5) If one takes a DC magnet (~50–100 G) and places it close to specific acupuncture points on the hand or arm, local analgesia is produced. Likewise, if one lays a subject with a kidney problem flat on a table and face up and then addresses the alarm point of the kidney meridian with a DC magnet, one leg on the subject will elongate relative to the other [11]. Thus, we see that a magnetic effect can be transferred to the physiological response level.
(6) It is well known that the organic molecule myosin is essential in muscle contraction. Myosin phosphorylation is involved in the expression of ATPase activity which accompanies muscle contraction. It has also been shown that *in-vitro* cell-free myosin phosphorylation exhibits a roughly linear increase in gamma^{32}P uptake by myosin light chains with static magnetic field strength increase [12]. Experiments with QiGong practitioners have shown that they can consistently reduce the phosphorylation due to a treatment at a 2–5 ft distance from the samples. Placing the samples in an Amunel magnetic shielding box produced a significant reduction in the subject's Qi effect in most cases — to the border of insignificance [13].
(7) Last, but not least, Smith [14] has found that water exhibits a type of memory characteristic *via* studies of the hypersensitivity of some humans to relatively weak electromagnetic fields at precise and patient-

specific frequencies that had been imprinted into water *via* a solenoid coil. The existence of this phenomenon has been confirmed through double-blind clinical trials [15] and seems to manifest in most cases *via* spastic muscle groups or greatly weakened muscle groups, in particular limbs or parts of the body of the person affected. Smith [14] found that EM treatment of water held both inside a solenoid coil or outside a toroidal coil was capable of imprinting frequency-type information into the water, provided the proper field intensities were above critical threshold levels. A sensitive dynamic electric filter method was developed to objectively read out these imprinted frequencies from the water onto a strip-chart recorder [16]. The water can hold this imprinted information for months before read-out but placing the imprinted water in an Amunel box for a short time completely erases the information [17]. Many of these anomalies can be traced to the odd behavior of water, which is certainly not considered to be magnetic in nature by all conventional standards.

As a first step towards understanding these key dualities, let us review our present-day picture of de Broglie's pilot waves [18, 19].

de Broglie's Pilot Waves

In 1924, de Broglie proposed a novel idea. He postulated that the motion of a physical particle is governed by the propagation of certain "pilot waves" which are intimately associated with the particle [18]. Further, the wavelength λ, the frequency ν, and the velocity v' of these pilot waves associated with a particle of momentum p, velocity v, and total relativistic energy E are given in terms of Planck's constant h by

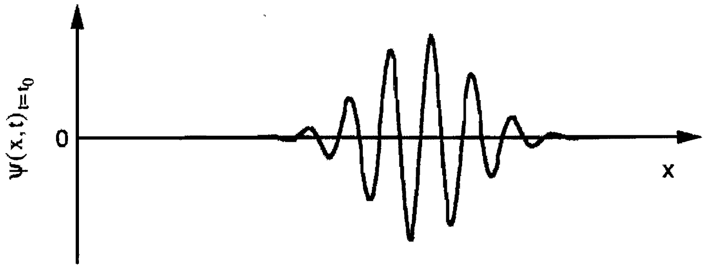
$$\lambda = \frac{h}{p}, \quad \nu = \frac{E}{h}, \quad v' = \nu\lambda = \frac{E}{p} \tag{1}$$

A plot of the net pilot wave shape profile must be qualitatively like the curve shown in Figure 2a with the physical particle being located somewhere within this envelope. The pilot waves form a group of waves and, as a function of time, the group must move along the x-axis with the same velocity as the particle.

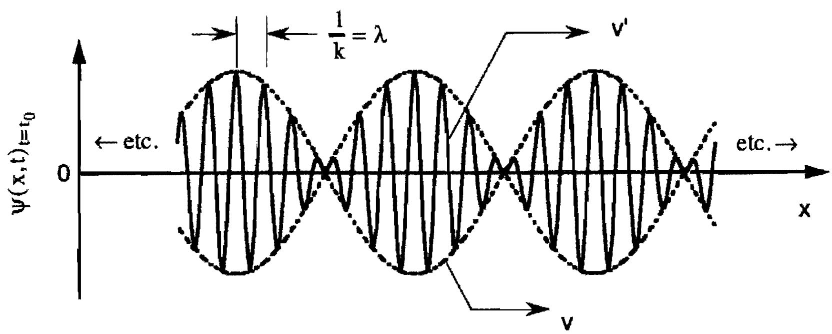
From straightforward mathematical analysis [19], one finds that

$$v' = c\left[1 + \left(m_0 c / p^2\right)\right]^{1/2}, \quad v_g = v = c^2 p / E \tag{2}$$

Here, m_0 is the rest mass of the particle, c is the velocity of light, and v_g is the



(a)



(b)

Fig. 2. (a) A group of pilot waves for a physical particle located somewhere in the group and (b) the sum of two sinusoidal waves of slightly different frequencies and wave numbers, *k*. The waves move at velocity v' while the group propogates at velocity v.

velocity of the moving group of waves. Of course, v_g is equal to the velocity v of the particle while the quantity v' is the velocity of the individual oscillations of the pilot waves which, *via* Equation (2), is always greater than the velocity of light c. In fact one finds that

$$v' = c^2 / v \quad (3)$$

so that, the smaller is v, the greater is v', with v' having the lower limit of $v' = v = c$. Since $v' > v_g$, the individual waves are constantly moving through the group from the rear to the front, just as one finds in a group of water waves.

To pictorially represent the difference between v_g and v', the sum of two simple harmonic waves of slightly different frequencies and wave numbers, k, is shown in Figure 2b ($k = 1/\lambda$). These two waves alternately interfere and reinforce in such a way as to produce an infinite succession of groups of pilot waves traveling in the direction of increasing x. The particle that is being piloted has equal probability of being in any group at time $t = 0$. However, its position within that particular group is undetermined to within a distance comparable to the length $\Delta x = 1/\Delta k$ of the group. Pursuing this line of reasoning further, quite naturally leads to the mathematical statement of the Heisenberg Uncertainty Principle [19],

$$\Delta x \, \Delta p_x = h / 2\pi \tag{4}$$

and certainly tends to validate the quantum existence of de Broglie's pilot waves.

Returning to Equation (3), let us suppose that the particle is the electron and let us utilize Dirac's picture of the formation of an electron from the vacuum [20]. This model successfully led to the prediction of the positron as a hole in the vacuum with positive energy, so that it was physically observable, and it tended to substantiate the initial supposition that the vacuum contained the negative energy solutions of Dirac's relativistic quantum mechanical equations for the electron. Of course, Dirac neglected the electron/photon interaction in his equations, which everyone did at that time because it came out to be infinite in all the existing theories, and thus missed also predicting the Lamb shift in the hydrogen spectrum. However, in spite of this neglect, the Dirac equation predicted the hydrogen spectrum with only a 0.1% discrepancy.

The first postulate of this paper is now made that, just as the electron travels in the physical domain at $v < c$ with positive energy, its companion pilot wave travels in the vacuum at $v' > c$ with negative energy. Thus, a plot of energy *versus* velocity for the electron and the electron pilot wave is expected to look like Figure 3. Here, the light barrier acts as a singularity-type point between the physically observable domain of electron experience and the physically non-observable domain of electron pilot wave experience. If one places the electron at a particular $v < c$, one can place its pilot wave on the $v' > c$ branch such that the combined energy is ΔE. Then one notes that, as v decreases, v' increases as required by Equation (3). Of course, $\Delta E = 0$ is one of the possible choices.

Although Figure 2b was developed by considering only two unmodulated waves, a very similar picture may be developed by using an infinitely large number of unmodulated waves, each with infinitesimally different k and v, which combine to form a single traveling group. We can consider this to be the group of Figure 2a by adjusting the phases of all the unmodulated waves so that, at the center of the group, they are all in phase. Proceeding away from the center in either direction, these unmodulated waves begin to become out of phase with each other (different k). Beyond some distances, they are completely out of phase and stay that way so their combination leads to total

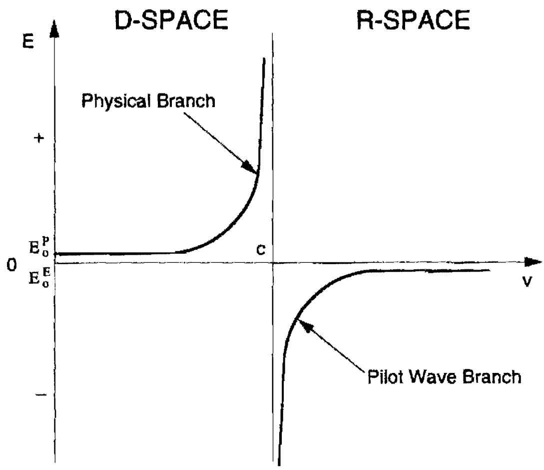


Fig. 3. Energy-velocity diagram for a D-space (distance-time) physical particle ($v < c$ branch) and its R-space (reciprocal space) pilot wave conjugate ($v > c$ branch).

destructive interference outside this range so that Figure 2a, rather than Figure 2b, represents the group.

Expanding on Figure 3, extended to all types of particles, the upper right-hand quadrant is the electrical superluminal (tachion) domain first discussed at length by Bilaniuk *et al.* [21]. For this domain, the particle mass is imaginary ($m' = i|m|$). By symmetry, the lower left-hand quadrant must be a magnetic subluminal branch ($m' = -i|m|$). It is satisfying that Terletski [22] has shown that, within the framework of relativistic kinematics and dynamics, there are no grounds for excluding any of these particles. Thus, the present framework of the theory of relativity admits three types of essentially different systems: (1) systems with positive proper mass, $m^2 > 0$, $E > 0$, (2) systems with negative proper mass, $m^2 > 0$, $E < 0$, and (3) systems with imaginary proper mass, $m^2 < 0$. Thus, all four categories of mass represented in the four quadrants of Figure 1 appear to be viable from the point of view of purely relativistic and quantum mechanical constraints.

All of the foregoing unfolds in a straightforward way when one assumes that the pilot wave concept holds and that wave-particle duality is a property of physical matter. In the next section, we shall see that, by considering two complementary types of matter operating in dual conjugate four-spaces, we can obtain all the results of this section plus many more.

An Eight-Space Model Comprising Dual Conjugate Four-Spaces

Of all possible sub-spaces available in an eight-space, let us focus our attention on two particular four-spaces [2]. One will be the familiar direct four-space (x, y, z, t) where x, y, z represent orthogonal distance coordinates and t represents time. The other will be its reciprocal four-space (k_x, k_y, k_z, k_t) where

$$k_x = \frac{a_1}{x}, \quad k_y = \frac{a_2}{y}, \quad k_z = \frac{a_3}{z}, \quad k_t = \frac{a_4}{t} \tag{5}$$

In the simplest case, we shall let $a_1 = a_2 = a_3 = a_4 = a$. This k-space is a natural wave space and has been greatly utilized by solid state physics as a vehicle for studying diffraction phenomena. Since the general model discussed in Ref. [2] is a diffraction model, we make the postulate, to be justified later, that substance in the direct space (D-space) is related to substance in the reciprocal space (R-space) by a Fourier transform [2, 23]; *i.e.*, in one-dimension,

$$F(k_x) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\infty} f(x) e^{-ixk_x} dx \tag{6a}$$

$$f(x) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\infty} F(k_x) e^{+ixk_x} dk_x \tag{6b}$$

where f represents the D-space distribution while F is its R-space counterpart. Bracewell [23] finds straightforward extension of the Fourier transform to a three-dimensional distribution in D-space and its counterpart in R-space, Komrska [24] extends this further to N-space where N can be much greater than 3 (see Appendix I).

By such a procedure, we can allow D-space to be particle space and R-space to be wave space and, by treating substance expression in nature as at least an eight-space phenomenon, we have "built-in" wave-particle duality. Further, since in D-space physical mass is positive, in R-space, Equations (I-3) show that the complementary mass is negative. This is fully consistent with the earlier discussion that, since physical particle energy is positive in D-space, its counterpart in R-space is negative. We thus see that R-space is the first substructure band of the vacuum so that the substance of this domain is not a physical observable *via* conventional probes. It is this R-space substance that acts as the de Broglie pilot wave for the physical substance of D-space.

The second postulate of this paper is that we identify the pilot wave for the electron as the magnetic monopole which, for simplicity, will be called the magneton. As a correlate of this postulate, it is proposed that all electric particles operating in D-space have pilot waves generated by fundamental magnetic moieties operating in R-space [2]. With this postulate, one restores a type of symmetry to nature and one clearly places the magneton in a physically non-observable realm which is at least consistent with the experimental experience concerning observations of the magnetic monopole. Because the magneton travels so fast, it is readily able to weave a pilot wave shape around the physical electron.

To expand on this picture in order to more fully appreciate the relationship between D-space and R-space substances, let us begin with singlet primordial **k**-waves plus their D-space counterparts and then proceed towards special groups of multiplet primordial **k**-waves and their particulate expression in D-space.

A. Pre-Particle Conditions

Modern texts [23] on Fourier transforms show that simple harmonic waves of the sine and cosine type in the k_x-direction of R-space lead to a pair of δ-functions in the x-direction of D-space. This is simply illustrated in Figure 4. Since the sine and cosine differ only by a π/2 phase shift, the general simple harmonic function in R-space with some particular phase shift also yields a pair of δ-functions along x with their strength depending upon the phase angle as illustrated *via* the bottom panel of Figure 4. From the mathematics one finds that, as the undulation interval Δk_x of the R-space wave increases, the δ-functions at positions $\pm x_0$ in D-space move closer to the origin and one finds that

$$x_0 = 2\pi / \Delta k_x \tag{7}$$

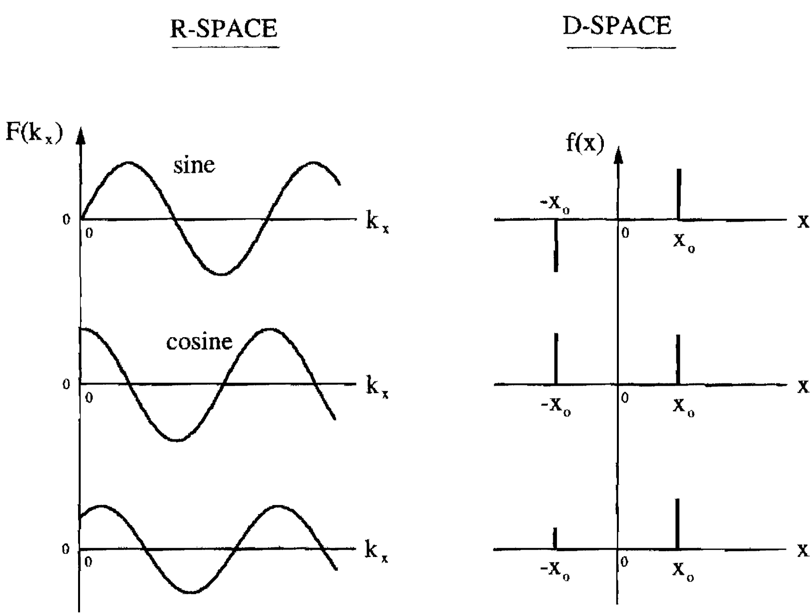


Fig. 4. Complementary substance representations in D-space and R-space. Particle-like delta functions in D-space have wave-like conjugates in R-space of simple sine and cosine type.

Further, as the amplitude of the undulations increase, the strength of the δ-functions increase linearly with the amplitude.

For a single δ-function, located at $x = x_0$ in D-space, the generating primordial k_x-wave in R-space is given by

$$f(x) = \delta(x - x_0), \quad F(k_x) = e^{-ix_0 k_x} = e^{-i(2\pi k_x / \Delta k_x)} \tag{8a}$$

when we introduce Equation (7) into Equation (8a). The results of Figure 4 are easily obtained from Equation (8a) by considering the mathematical identities connecting the sine and cosine functions to the exponential functions. To shift the δ-function an amount Δx, in D-space, one need only alter this primordial singlet by the phase factor $2n\pi = \Delta x \cdot k_x$, where n is an integer, in R-space. Thus, if one has unlimited control of the phase of such a primordial singlet **k**-wave, one can displace this δ-function to any arbitrary position along the x-axis of D-space. Using a superposition of such plane waves, the δ-function can be replaced at any arbitrary position (x_0, y_0, z_0, t_0) in the four-dimensional D-space; *i.e.*,

$$f(x,y,z,t) = f(\mathrm{r}) = \delta(x - x_0, y - y_0, z - z_0, t - t_0) = \delta(\mathrm{r} - \mathrm{r}_0)$$

$$F(k_x, k_y, k_z, k_t) = F(\mathrm{k}) = \exp\left[-i(x_0 k_x + y_0 k_y + z_0 k_z + t_0 k_t\right]$$

$$= e^{-i\mathrm{r}_0 \mathrm{k}} = e^{-i(2\pi k / \Delta k)} \tag{8b}$$

Thus, by controlling the phase of this primordial singlet **k**-wave in four-dimensional R-space, this δ-function can be displaced to any position of four-dimensional D-space. It doesn't take much imagination to see that, at least metaphorically, we are close to describing a type of wave-particle duality here when one considers the interplay between these reciprocal four-spaces. To proceed, let us drop back to our simple singlet plane wave of Equation (8a) and slowly enrich the picture step by step.

B. Time-Flow

In our four-dimensional D-space, time must always be taken into account even if one only allows δ-function excursions along the x-axis; *i.e.*,

$$f(x,t) = \delta(x - x_0, t - t_0)$$

$$F(k_x, k_t) = e^{-i(x_0 k_x + t_0 k_t)} = \exp\left[-2\pi i\left(\frac{k_x}{\Delta k_x} + \frac{k_t}{\Delta k_t}\right)\right] \tag{8c}$$

where t_0 can be taken to represent the "now," a point in the past or a point in the future. Since our cognitive experience of D-space is that objective time appears to flow only in the forward direction, for our δ-function to remain at x_0 in the continually changing "now" as viewed from our reference frame, the phase factor in Equation (8c) must change in a predictable fashion. In fact, for the δ-function to remain at $x = x_0$ in the "now," we must define

$$t_0 = t_{00} + \alpha_1 \Delta t + \alpha_2 \Delta t^2 + \cdots \tag{9}$$

where t_{00} is an absolute constant, Δt is the time interval that has passed since $t_0 = t_{00}$ and the α_j are constant coefficients. For simplicity, we could consider only small values of Δt so that only the term linear in Δt need concern us and, because we require an equation analogous to Equation (7) to hold for the time-axis, we have

$$t_{00} + \alpha_1 \Delta t = 2\pi / \Delta k_t \tag{10a}$$

so that

$$\Delta k_t = 2\pi / (t_{00} + \alpha_1 \Delta t) \tag{10b}$$

and the undulation interval of the k_t-axis waves in R-space must decrease in a linear fashion. It is almost as if our observational frame for D-space is attached to a flowing river, call it the "river of time" if you will, and something beyond eight-space is controlling the flow of the river. Of course, in the general instance that Δt is not small, this river flow exhibits non-linear behavior; *i.e.*,

$$\Delta k_t = \frac{2\pi}{t_{00} + \sum_{j=1}^{\infty} \alpha_j \Delta t^j} \tag{10c}$$

in order to maintain a constant phase factor for $F(k_x, k_t)$ from Equation (8c). This is a necessary condition for one to observe the δ-function at an unchanging position on the x-axis of D-space throughout the passage of time.

One might ask "what abrupt changes in R-space abruptly shift the δ-function from x_0 to $x_0 + \Delta x_0$?" This only requires an abrupt change in the k_x-axis primordial wave undulation interval from Δk_x to $\Delta k_x'$ where

$$\Delta k_x = \frac{2\pi}{x_0}, \quad \Delta k_x' = \frac{2\pi}{x_0 + \Delta x_0} \tag{11a}$$

For constant velocity movement of the δ-function along the x-axis over the distance interval x_0 to $x_0 + \Delta x_0$ and time interval t_0' to $t_0' + \Delta t_0'$ one requires only that

$$\Delta k_x = \frac{2\pi}{x_0} \text{ for } t \le t_0'$$

$$\Delta k_x' = \frac{2\pi}{x_0 + v_x \Delta t} \text{ for } 0 \le \Delta t' \le \frac{\Delta x_0}{v_x} \tag{11b}$$

where v_x is the velocity along the x-axis. Thus, the k_x-axis undulation interval in R-space must change in a well-defined way with time, or more properly with its k_t-axis undulation interval Δk_t, in the following way:

$$\Delta k_x' = \frac{2\pi}{\left[x_0 + \frac{v_x}{\alpha_1}\left(\frac{2\pi}{\Delta k_t} - t_0'\right)\right]} \tag{11c}$$

In a similar fashion, one could state the specific R-space conditions needed for δ-function movement at constant acceleration a_x along the x-axis of D-space over the interval x_0 to $x_0 + \Delta x_0$ and t_0' to $t_0' + \Delta t_0'$. Then one ends up with a somewhat more complex expression than Equation (11c) connecting $\Delta k_x'$ to Δk_t, x_0, t_0', v_x and a_x. To have our δ-function perform simple harmonic motion along x, circular motion in the xy plane or a spherical path in D-space, well-defined relationships between Δk_t and the other undulation intervals are easily developed (see Appendix II).

Now that the formation and motion of an individual δ-function in D-space has been dealt with, let us now postulate that it is clusters or microgalaxies of such δ-functions that form one of the key foundation stones for physical particle formation in D-space. It is beyond the scope of the present paper to deal with that phase of the work and it will be left for a subsequent paper; however, it will be noted here that it is a multiplet primordial **k**-wave that one needs to define the locations and correlated motions of a small galaxy of δ-functions; *i.e.*,

$$P_n = \sum_{j=1}^{n} a_j \delta_j (x - x_{0j},\ y - y_{0j},\ z - z_{0j},\ t - t_{0j}) \tag{12a}$$

$$K_n = \sum_{j=1}^{n} a_j \exp\left\{-2\pi i \left[\frac{k_x}{\Delta k_{xj}} + \frac{k_y}{\Delta k_{yj}} + \frac{k_z}{\Delta k_{zj}} + \frac{k_t}{\Delta k_{tj}}\right]\right\} \tag{12b}$$

At this point, it has been shown that there is a fundamental and very basic connection between the undulation intervals of the singlet primordial **k**-wave components in four-dimensional R-space and its conjugate δ-function moiety position in four-dimensional D-space. However, this is pictorially quite different from the totally D-space picture of the particle and its associated pilot wave given in Figure 2a. In order to integrate these two views, discussion of Maxwell's equations and the Mirror Principle are needed. These follow in the next two sections.

Reconciling Maxwell's Equations

Although, from the foregoing, magnetic charge has found a home in the physically non-observational frame of the vacuum and thus div $\mathbf{B} = 0$ for the physical frame as required, how does one accommodate the physically observable **B**-field properties manifested by different materials and both the magnetic flux, **B**, and d**B**/dt in Maxwell's equations?

To answer this question, one begins by realizing first that, since spatial or temporal waveforms and their spectra are Fourier transforms of each other, if the faster than light domain is a frequency domain, wave/particle duality would be potentially maintained if any physical particle and its magnetic counterpart or pilot wave had a Fourier transform relationship with respect to each other. Thus, one now has a physical electric particle moving about in our normal cognitive four-space domain of distance-time and its companion magnetic moiety moving about in a presently non-cognitive four-space domain in which each of the coordinates is a frequency coordinate. In other words, each coordinate axis of this new four-space is an inverse of one of the coordinates in our conventional (x, y, z, t) four-space; *i.e.*, $(x^{-1}, y^{-1}, z^{-1}, t^{-1})$.

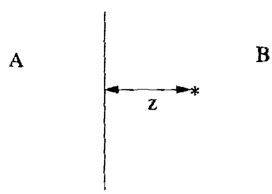
Next, one must allow the magnetic moiety (pilot wave) to interact with its companion (conjugate) electric particle but they are separated by the light barrier. This leads to the third postulate of this paper which is that these two cognitive four-space frames, which are dual to each other in a special way, are imbedded in a higher-dimensional frame (a nine-space, the emotion frame of Figure 1) wherein one of its substances (call it deltron for pedagogical purposes) can interact with electric matter at $v < c$ and also interact with magnetic matter at $v' > c$ because it is not subject to the constraints of the $v = c$ singularity. Thus, this higher-dimensional substance (deltron) can act as a kind of "fluid clutch" allowing an indirect interaction to occur between the electric and magnetic substances. One now asks what is required for this interaction to yield the standard expressions for Ampere's and Faraday's laws as represented in Maxwell's equations.

Just as the Charge Superposition Principle [25] provides an equation for the electrostatic potential V in terms of the electric charge distribution ρ_e in the (x, y, z, t) frame, an analogous equation provides a relationship for the magnetic vector potential **A** in terms of the magnetic charge distribution ρ_m in the $(x^{-1}, y^{-1}, z^{-1}, t^{-1})$ frame. The degree of coupling between the two substances is, to first order, expected to increase linearly as the local deltron density increases so that a dipolar image of each electric charge appears in the

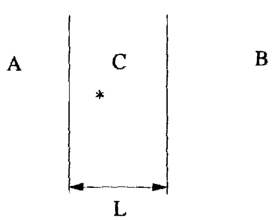
$(x^{-1}, y^{-1}, z^{-1}, t^{-1})$ frame traveling at $v > c$ and a dipolar image of each magnetic charge appears in the (x, y, z, t) frame traveling at $v < c$. This transformation is considered to be a property of the interfacial domain between these two frames in their respective image formation directions.

As physical analogs to illustrate this transformation a little more plausibly, suppose one has in the (x, y, z, t) frame, a half-space of material A joined at a planar interface to a half-space of material B as illustrated in Figure 5a. A singularity (electric charge, edge dislocation [26], *etc.*) is placed in material B at a position some distance from the interface. Mathematics shows that some type of image of that singularity will appear somewhere in material A in order to satisfy the proper boundary conditions at the interface. Something very similar can be expected to happen at the (x, y, z, t)/deltron/$(x^{-1}, y^{-1}, z^{-1}, t^{-1})$ interface *via* part of what will be called the "Mirror Principle."

If one places a single singularity, like an edge dislocation, in phase B a distance z from the interface then, in the most general case, a cluster of image singularities is needed in A to balance (1) the vector mechanical displacement



(a)



(b)

Fig. 5. (a) Two semi-infinite extent material domains, A and B, with a singularity, *, a distance z from the A/B interface in phase *B*; (b) the same as (a) but with an interface material *C* of width *L* that contains the * singularity.

continuity equations along the interface and (2) the vector mechanical traction continuity equations along the interface. Under special conditions of crystal classes for A and B as well as crystallographic orientations for the interface planes and interface direction-normals, the image singularities can reduce to quadrupole or dipole nature. If both materials are piezoelectric and one is considering a simple electric charge singularity in B, one needs eight boundary conditions to be applied at the interface to satisfy the constraints of the image charges which will be multiple in general. Even if material B is a simple dielectric (tensor of rank 2), five boundary conditions must be applied (three specifying tractions, one specifying continuity of electric potential and one more specifying continuity of electric displacement). As one moves to higher-order tensors for A and B, the multiplicity of image singularities in material A needed to balance a single singularity in material B will increase. Even when B is a tensor of rank 1 and A is a tensor of rank 2, multiple image singularities will generally be needed. Thus, according to this line of reasoning, it seems plausible to expect that the trans-dimensional mirror proposed here may produce a special mapping transform for image transfer in the two directions across this "mirror."

For complete satisfaction of Maxwell's equations, the mirror transform need have only two aspects: (1) the **A**-distribution due to the magnetic charge in the frequency domain image-maps into curl **A** in the space-time domain and this is recognized as the dipolar **B** [25] and (2) the electric charge distribution in the space-time domain image-maps into a dipolar electric field in the frequency domain which, in-turn, image-maps back into the space-time domain as $\Delta\mathbf{E}$ where $\Delta\mathbf{E}$ is equal to the time derivative of $-\mathbf{A}$ so that the total electric field in the space-time domain is now given by the standard form [25]. Ascribing these two properties to this special mirror between the space-time and frequency cognitive domains is sufficient to yield the standard expressions for Maxwell's equations in space-time [25] and, since the space-time domain is a source-free domain for **A** (*i.e.*, $\nabla \bullet \mathbf{A} = 0$), this leads to the familiar expression relating **A** to the integral of the current density **J** over the local volume [25].

Utilizing the procedures of the previous section, one can straightforwardly specify the type of primordial **k**-wave in R-space needed to produce a stationary or moving dipolar moiety in D-space. Since the **k**-wave, $\exp(-ik_x x_0)$, produces a monopolar singularity in D-space at the position $(x_0, 0, 0, 0)$, a dipolar singularity at x_0 with the dipole aligned in the y-direction requires a **k**-wave, φ_d, given by

$$\varphi_d = e^{-ik_x x_0}\left[e^{-ik_y l/2} + \left(-e^{-ik_y(-l/2)}\right)\right]$$

$$= -2i \sin\left(k_y l / 2\right) e^{-ik_x x_0} \qquad (13)$$

where l is the dipole length. To align the dipolar moiety in any other direction requires only that k_y in Equation (13) be replaced by the **k**-value appropriate to that specific direction. Movement of this dipolar singularity follows the procedures outlined in the previous section.

Although dipolar singularities in D-space can be created and moved by specific **k**-waves in R-space, imbuing them with either electric or magnetic qualities is another matter entirely. Quantitatively resolving this issue is beyond the scope of the present paper; however, at least a conceptual picture of the process can be given here by describing a distant analogy in D-space.

Consider the three-phase material system illustrated in Figure 5b. Let A be of semi-infinite extent and be a material of tensor rank m; let B also be of semi-infinite extent but be a material of tensor rank $p > m$ and let C be of thickness L and a material of tensor rank $s > p > m$. Suppose, now, that we place a singularity at some location in phase C and consider the images that are produced in phases A and B. This example is thought to somewhat represent the situation of having a substance singularity in the nine-dimensional frame of emotion that simultaneously produces dual images in D-space and R-space. Returning to Figure 5b, the * singularity in phase C will have one or more primary images in phase A and in phase B. These primary images, in turn, produce secondary images in A and B, *etc.* Thus, a single singularity in phase C will produce an array of singularities in phase A with some uncertainty of centroid position because, in the four-dimensional perspective of D-space, there will also be effects on the time component of the four-space position vector. This may form the basis for the Heisenberg uncertainty principle in our present wave-particle description of nature. Obviously, since phase A and phase B are tensors of different rank difference compared to phase C, the image arrays in phase A and phase B may be quite different from each other and these differences are thought to distinguish the electric particle quality of phase A from the magnetic wave quality of phase B (see Appendix III).

Returning to the model expressed in Figure 1 and more generally in Ref. [2], the proposed mechanism for the propogation of a specific spirit-level intention to D-space materialization is (1) imprinting a specific pattern on the nodal network of the mind domain [2], (2) diffraction of this pattern onto its first reciprocal nodal network, that of R-space, and (3) exciting the emission of additional deltrons from the emotional domain to allow the R-space pattern to transfer robustly to D-space [2]. In this cascade process, it was earlier proposed [28] that the substance of the subtle domains interacts with the substance of the physical domain *via* the development of an additional contribution $\mathbf{A}_2$ to the magnetic vector potential function $\mathbf{A}$ of the D-space region under consideration. If we call the existing magnetic vector potential of the D-space region prior to the specific intention under consideration $\mathbf{A}_1$, then after the intention event we have

$$\mathbf{A} = \mathbf{A}_1 + \mathbf{A}_2 \tag{14a}$$

where $\mathbf{A}_1$ is the solution to Maxwell's standard equations and $\mathbf{A}_2$ is given by

$$\mathbf{A}_2 = \eta f(\varphi) \tag{14b}$$

Here, φ represents the effective subtle domains potential, f is some functional form and η is a collective material parameter. We can expect $\mathbf{A}_2$ to have some spatial and temporal dependence. The reason for this is illustrated by the change in the R-space map of **k**-wave amplitude associated with the specific intention. It is this specific magnetic potential map change in R-space that produces a specific $\mathbf{A}_2$ distribution in four-dimensional D-space. Because of such **A** injections into D-space, Maxwell's equations must be modified and take the form developed in Appendix IV. The spatial and temporal dependence of $\mathbf{A}_2$ is not known but, in parameterized form, we might approximate it with

$$\mathbf{A}_2 \approx \theta e^{-a\left(x^2+y^2+z^2\right)} e^{-bt}\left(1-e^{-ct}\right) \tag{14c}$$

where θ, a, b and c are constants that depend on the deltron concentration. Thus, $\mathbf{A}_2$ decays exponentially with distance about some specific location while it rises exponentially in time to some maximum value and then decays again with time at a different rate. With the passage of time and abundant experiments in this area, the correct form of $\mathbf{A}_2$ will undoubtedly be discovered.

The "Mirror" Principle

When one thinks of a mirror it is usually a reflection mirror because that is a part of our daily experience. However, here, one is dealing with a kind of inversion mirror and we have very little prior experience with such mirrors. First, the dual cognitive four-dimensional frames are reciprocals of each other, a special kind of inversion, and the substance characteristics populating the two frames are oppositely configured. In the D-space frame, one has substance with a particulate electric nature of positive mass and positive energy that always travels slower than physical light. By contrast, in the R-space frame, one has substance with a wave-like magnetic nature of negative mass and negative energy that always travels faster than physical light. The positive mass creates curvature effects in the D-space frame that manifest in the gravitational force while, as perceived with the same cognitive system, the negative mass moieties acting *via* the deltrons should develop levitational force effects in the D-space frame. This should produce a significant effect on the Cosmological Constant [2]. The R-space effects can be perceived only *via* another cognitive pathway with the curvature effects of the two types of masses probably being reversed compared to the D-space effects.

Since what one perceives in D-space as an increasing temperature is associated with increasing kinetic energy of positive mass substance in D-space, the Mirror Principle would suggest that the negative mass substance acting on D-space *via* the deltrons would exhibit a decreasing temperature effect. This is consistent with Equation (3) wherein, as the physical particle increases in velocity, its pilot wave decreases in velocity and moves to a larger magnitude negative energy condition (see Figure 3).

In terms of entropy, electric substance of D-space yields positive entropy as a consequence of the formation of distinguishable disorder in a sea of order whereas magnetic substance of R-space yields negative entropy as a consequence of the formation of order in a sea of disorder. The corresponding free energies are positive for the D-space substance and negative for the R-space substance.

As discussed in the previous section, a well-defined set of Maxwell's equations function in D-space driven primarily by the movement of electric charges and magnetic dipole images. This is a source-free domain for magnetic charge but not for electric charge. On the other side of the mirror, in R-space, another set of Maxwell-type equations exist driven by the movement of magnetic charges and electric dipole images. This domain is source-free for electric charge but not for magnetic charge. The magnetoelectric waves of the R-space domain are thought to travel at velocities much greater than c in physical vacuum and to speed up on entering dense physical matter while the electromagnetic waves of the D-space domain are known to travel at c in vacuum and to slow down on entering dense physical matter.

As a closing note to this section, in the applications area, it is thought that allopathic medicine is based primarily on D-space substance while homeopathic medicine is based primarily on R-space substance in aqueous solution.

Discussion

With the present reinterpretation of magnetism, the spin quantum number of elementary particles is seen, not as a fundamental property of D-space substance, but as a convenient parameter to characterize the projection of R-space substance onto D-space. In this way, it is analogous to the wave-particle behavior mode of description for D-space particles. Although spin is accepted as a property of matter, where it comes from and why it is there is not at all understood in any fundamental sense by today's physics community. Such basic questions are now being seriously raised because of a longstanding inability to explain the proton's supposed well-defined spin of +1/2 in terms of the bits and pieces (quarks and gluons) inside it [29]. The proposal of this paper is that, if one moves to the proper dimensional level (eight- or nine-space) for description of physical phenomena, both the spin quantum number and wave-particle duality can be discarded as relevant terms.

Returning to the list of magnetic anomalies listed in the introduction, the present paper would propose that the Baron von Reichenback research results [7] are most likely to be attributable to a variety of magnetoelectric phenomena. His "sensitive" subjects, unlike most humans, seem to be cognitively aware of R-space events with their well-developed psychic sense and interpret these phenomena as unfolding in real time. The fact that such individuals would work better inside a Faraday cage is most likely attributable to the noise reduction associated with the elimination of most of the electromagnetic signals from the environment while the R-space magnetoelectric signals would pass through the cage unhindered. Placing such individuals in a magnetically shielded room would block the R-space information signals so that they would be unable to directly perceive the magnetoelectric phenomena unless they were capable of going to an even higher level of perception.

The importance of magnetism to dowsing, enzymatic activity, kinesiology, cellular function and water may, to first order, all be related to some special R-space and deltronic properties of water that are presently quite unappreciated. If multi-dimensional water exhibits a high concentration of deltrons, then strong coupling will exist between the R-space and D-space substances. Further, if the R-space component of water is very magnetically polarizable then strong ordering of this domain is readily achievable at small field strengths. This would reflect itself to some degree on the D-space properties of water and, experimentally, one observes a large variety of anomalous behavior with water [30-33]. It is almost as if most materials have only a small degree of D-space/R-space substance coupling compared to water. Thus, it requires either enormous magnetic field strengths or profound human intention focus to produce anomalous behavior in these materials from a D-space perspective. However, water is perhaps so strongly coupled that only small magnetic field strengths or unexceptional directed human intention can produce strikingly anomalous behavior. This proposal is certainly consistent with the longstanding practice of "blessing" water for a wide variety of uses and is quite consistent with the recent findings of del Guidice and Preparata with respect to coherence states of water [34, 35]. Since this recent work utilized quantum mechanical calculations, they attributed the coherence domains in water to the D-space domain substance but this seems unlikely based upon several decades of careful D-space experimentation on water [32, 33]. If, as proposed here, quantum mechanics is primarily a D-space representation of an R-space/D-space projection, then the location of these coherence domains could be in the R-space substance of water and only secondarily influence D-space water properties. Likewise, the experiments of Smith [14, 16] could write an ordered network of structure in the essentially incoherent R-space water substance and it might survive for months to years in spite of reasonably strong convection occurring in the D-space substance of water over that time frame.

Because a physical particle in D-space has positive energy and it has been shown here that its R-space counterpart has negative energy (Equations (1-3)), Figure 3 and Equation (3) show that these energies are tied together in a specific way so that the sum of the kinetic energies, E_T, is given by

$$E_{\mathrm{T}} = \frac{1}{2} m_{\mathrm{D}} v^2 + \frac{1}{2} m_{\mathrm{R}} v'^2 = \frac{m_{\mathrm{D}} v^2}{2} \left[1 + \frac{m_{\mathrm{R}}}{m_{\mathrm{D}}} \left(\frac{c}{v} \right)^4 \right] \tag{15}$$

where m_D and m_R are the D-space and R-space masses, respectively. Since $m_R/m_D < 0$, one sees that E_T can be zero for $(v/c)^* = |m_R/m_D|^{1/4}$.

In general, the Fourier transform (FT) is a complex number and the intensity of substance, I_R, in R-space is a negative quantity. Since this is unfavored by the physics community, they have chosen to consider the modulus M_R rather than I_R, *via* the relationship

$$M_{\mathrm{R}}(k) = \left[\mathrm{FT}(k) \cdot \mathrm{FT}^*(k) \right]^{1/2} = \left[(\mathrm{Re\,FT})^2 + (\mathrm{Im\,FT})^2 \right]^{1/2} \tag{16}$$

where FT^* is the complex conjugate of FT. This is a longstanding practice of the physics community and is certainly a requirement for representing an eight-space quality as a four-space physical observable clothed in the rubric "wave-particle duality."

It has also been shown here that the maintenance of a δ-function moiety in the "now" at a fixed position of D-space relative to some fixed reference frame requires a specific change in the undulation interval Δk_t of the k_t-component of the singlet primordial **k**-wave. This, in turn, points to a higher-dimensional force needed to bring about this specific change in Δk_t. It also opens a rational possibility for both dematerialization and materializaiton of objects by intention-directed manipulation of Δk_t so as to, respectively, move objects either out of or into the "now." It also opens a rational possibility for intention-directed manipulation of time experience *via* possible non-linear contributions imbedded in Equations (9) and (10c).

When one looks at Equations (7) and (8), one notes that it is only a type of phase factor in the singlet primordial **k**-wave that differentiates the D-space position of a δ-function moiety. This is quite possibly the basis for both the phenomenon of remote viewing and that of distant healing when the human operator is able to intentionally adjust this phase factor in their R-space transmitter/receiver, antenna system. It is an unproven supposition on the author's part that all humans have this type of hardware available in their bodies although this may perhaps be inferred from some of Pribram's work [34]. His work indicates that cortical neurons act like individual receiving antennas in a large array converting D-space information into a diffraction pattern (R-space information) whose mathematical representation is very close to the Fourier transform of the D-space information [2]. Conscious awareness of the D-space information pattern requires the occurrence of an inverse Fourier transform in the processing chain. Thus, both R-space *and* D-space information maps seem to be present in our body's hardware and this may be the basis for both the remote viewing and the distant healing capabilities in the human species.

In closing this discussion, the D-space/R-space observational frames and the electric monopole/magnetic monopole substance differentiations appear to allow all of the old utility of the prevailing model and the new model allows the possibility of explaining a significant variety of new phenomena. At least a nine-space description will be required for a proper quantitative expression of the main concepts brought forward for consideration here (ten-space if intention is included). However, although the present level of modeling has real limitations, it allows one to qualitatively, and even semi-quantitatively in some cases, gain an appreciably broader perspective of both the physical and the subtle domains of nature and their modes of interaction. In this context, it seems reasonable to speak in terms of *both* the D-space band *and* the R-space band of physical reality rather than use the past nomenclature of physical and conjugate physical or etheric realities.

Acknowledgments

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References

[1] Tiller, W.A. (1993). What are subtle energies? *J. Scientific Exploration,* 7, 293.
[2] Tiller, W.A. (1997). *Science and Human Transformation: Subtle Energies, Intentionality and Consciousness.* Walnut Creek, CA: Pavior Publishing.
[3] Kaku, M. (1994). *Hyperspace.* New York: Oxford University Press.
[4] Harmuth, H.F. (1986). Correction of Maxwell's equations for signals I. *IEEE Transactions on Electromagnetic Compatibility,* 28, 250.
[5] Seiberg, N. and Witten, E. (1994). Electric-magnetic duality, monopole condensation and confinement in $N=2$ supersymmetric Yang-Mills theory. *Nuclear Physics B,* 426, 19.
[6] Barrett, T.W. (1988). Comments on the Harmuth Ansatz: Use of a magnetic current density in the calculation of the propagation velocity of signals by amended Maxwell theory. *IEEE Transactions on Electromagnetic Compatibility,* 30, 419.
[7] von Reichenback, C. (1850). *Vital Force.* New York: J.S. Redfield.
[8] Bird, C. (1979). *The Divining Hand.* New York: E.P. Dutton.
[9] Smith, M.J. (1972). Paranormal effects on enzyme activity. *Human Dimensions,* 1, 15.
[10] Miller, R.N. (1977). Methods of detecting and measuring healing energies. *Future Science.* New York: Anchor-Doubleday.
[11] Goodheart, Jr., G.J. (1964). *Applied Kinesiology.* Detroit: Privately published.
[12] Markov, M.S., Pilla, A.A. and Wang, S. (1993). Effects of weak low frequency sinusoidal and D.C. magnetic fields on myosin phosphorylation in a cell-free preparation. *Biochemistry and Bioenergetics,* 30, 119.
[13] Meuhsam, D.J., Markov, M.S., Meuhsam, P.A., Pilla, A.A., Shen, R. and Wu, Y. (1994). Effects of Qigong on cell-free myosin phosphorlyation: Preliminary experiments. *Subtle Energies,* 5, 93.
[14] Smith, C.W. (1994). Electromagnetic bioinformation and water. *Ultra High Dilutions-Physiology and Physics,* Eds., Endler and Schulte. New York: Kluwer Acad. Pub.
[15] Rea, W.J., Fan, Y., Fenyves, E.J., Sujisawa, I., Suyama, H., Samadi, N. and Ross, G.H. (1991). Electromagnetic field sensitivity. *J. Bioelectricity,* 10, 241.
[16] Smith, C.W. (1998). Is a living system a macroscopic quantum system? *Frontier Perspectives,* 7, 1, Fall/Winter, 9.
[17] Smith, C.W. (1995). Private Communication, August.
[18] de Broglie, L. (1926). *Compt. rend.,* 183, 447; (1927). *Compt. rend.,* 185, 380; (1954). *Revolution in Modern Physics.* London: Routledge and Kegan Paul; Bohm, D. (1951). *Quantum Theory,* NJ: Prentice-Hall.
[19] Eisberg, R.M. (1961). *Fundamentals of Modern Physics.* New York: John Wiley & Sons.

[20] Aitchison, I.J.R. and Hey, A.J.G. (1982). *Gauge Theories in Particle Physics.* Bristol: Adam Hilger Ltd.
[21] Bilaniuk, O.M., Deshpande, V.K. and Sudarshan, E.C.G. (1962). Particles beyond the light barrier. *Am. J. Phys.*, 30, 718.
[22] Terletski, Y.P. (1961). *Paradoxes in the Theory of Relativity.* New York: Plenum Press.
[23] Bracewell, R. (1965). *The Fourier Transform and Its Applications.* New York: McGraw-Hill Book Company.
[24] Komrska, J. (1992). The Fourier transform of lattices. *Proceedings of the International Summer School on Diagnostics and Applications of Thin Films,* May 27-June 5, 1991. Czechoslovakia: IOP Publishing Ltd.
[25] Kraus, J.D. and Carver, K.R. (1973). *Electromagnetics.* New York: McGraw-Hill Book Company.
[26] Cottrell, A.H. (1953). *Dislocations and Plastic Flow in Crystals.* London: Oxford Clarendon Press.
[27] Dzyaloshinskii, I. E., Lifschitz, E.M., Pitaevskii, L.P. (1961). The general theory of Van der Walls forces. *Advances in Physics,* 10, 165.
[28] Tiller, W.A., Green, E.E., Parks, P.A. and Anderson, S. (1995). Towards explaining anomalously large voltage surges on exceptional subjects: Part I. The electrostatic approximation. *J. Scientific Exploration,* 9, 331.
[29] Peterson, I. (1997). Proton-go-round: Whence does the proton get its spin? *Science News,* 152, 158.
[30] Drost-Hansen, W. (1965). Anomalies in the properties of water, in *Proceedings of the First International Symposium on Water Desalination* (Washington, DC); (1971). Structure of water near solid interfaces, in *Chemistry and Physics of Interfaces II,* Ed. D.E. Gushee. Washington, DC: Am. Chem. Soc. Publications, Ch. 15.
[31] Hobbs, P.V. (1974). *Ice Physics.* Oxford: Clarendon Press.
[32] Franks, F. (1972). *Water, a Comprehensive Treatise (7 Vols.).* New York: Plenum Press.
[33] Eisenberg, D. and Kauzmann, W. (1969). *The Structure and Properties of Water,* New York: Oxford University Press.
[34] Pribram, K. (1991). *Brain and Perception, Holonomy and Structure in Figural Processing.* Hillsdale, NJ: Lawrence Erlbaum Associates.
[35] Del Giudice, E. and Preparata, G. (1994). Coherent dynamics in water. *J. Biol. Physics,* 202, 105.
[36] Preparata, G. (1995). *QED Coherence in Matter.* London: World Scientific Publishing Co.

Appendix I
The Fourier Transform of *N*-space

Komrska [24] showed that the generalized Fourier transform for *N*-space can be given by

$$F(\mathbf{k}) = A^N \int_{-\infty}^{\infty} \ldots \int f(\mathbf{x})\, e^{-ip\,\mathbf{x}\cdot\mathbf{k}} d\,\mathbf{x} \qquad \text{(I - 1a)}$$

$$f(\mathbf{x}) = B^N \int_{-\infty}^{\infty} \ldots \int F(\mathbf{k})\, e^{+ip\,\mathbf{x}\cdot\mathbf{k}} d\,\mathbf{k} \qquad \text{(I - 1b)}$$

where A and B may be mathematically complex constants but p must be a mathematically real constant and these three constants must satisfy the condition

$$AB = \frac{|p|}{2\pi} \qquad \text{(I - 1c)}$$

If, for simplicity, we choose $N = 4$, $|p| = 1$ and $A = B = (1/2\pi)^{1/2}$, then physical substance in D-space and its counterpart substance in R-space can be related by

$$F(\mathbf{k}) = \frac{1}{(2\pi)^2} \int_{-\infty}^{\infty} f(\mathbf{r})\, e^{-i\mathbf{r}\cdot\mathbf{k}} d\mathbf{r} \qquad \text{(I - 2a)}$$

$$f(\mathbf{r}) = \frac{1}{(2\pi)^2} \int_{-\infty}^{\infty} F(\mathbf{k})\, e^{+i\mathbf{r}\cdot\mathbf{k}} d\mathbf{k} \qquad \text{(I - 2b)}$$

where **r** and **k** are four-vectors in D-space and R-space, respectively.

Suppose, now, we let $f(\mathbf{r})$ represent the mass distribution of a primary physical particle in D-space and we consider it to be of uniform density m_0 over some small volume $(\Delta\mathbf{r})^4$ of D-space. Since $F(\mathbf{k})$ is actually the spectral amplitude distribution of the complementary mass in R-space, the intensity distribution of this mass can be considered to be proportional to $i^2F^2(\mathbf{k})$ and we find that

$$i^2F^2(\mathbf{k}) = -\frac{m_0^2}{2\pi^2\mathbf{k}} \sin^2\left(\frac{\mathbf{k}\Delta r}{2}\right) \qquad \text{(I - 3a)}$$

Thus, since in D-space physical particle mass m_0 is positive, in R-space the mass of the complementary substance would be negative.

Appendix II
Some R-space Undulation Interval Recipes for Specific D-space δ-function Loci

To have our δ-function perform simple harmonic motion along the x-axis of D-space requires a slightly more sophisticated connection between $\Delta k_x'$ and Δk_t than provided by Equations (11); *i.e.*, for

$$x_0(\Delta t') = x_0(0) + A \sin \omega t', \quad t_0 = t_0' + \Delta t' \qquad \text{(II - 1a)}$$

with

$$\Delta k_x' = \frac{2\pi}{x_0(\Delta t')}, \quad \Delta k_t = \frac{2\pi}{t_0' + \Delta t'} \qquad \text{(II - 1b)}$$

requires that

$$\frac{dx_0}{dt_0} = \frac{dx_0}{d\Delta t'} = A\omega \cos\left[2\pi\omega\left(\frac{1}{\Delta k_t} - \frac{t_0'}{2\pi}\right)\right]$$

$$= \left(\frac{\Delta k_t}{\Delta k_x'}\right)^2 \frac{d\Delta k_x'}{d\Delta k_t} \qquad \text{(II - 1c)}$$

using the differentiation chain rule. To have our δ-function perform circular motion in the xy plane of D-space requires coordinated changes of $\Delta k'_x$ and $\Delta k'_y$ in terms of Δk_t in R-space. The procedure is straightforward following the example of Equation (II-1) and starting with

$$x_0(\Delta t') = x_0(0) + A\cos(\omega_1 \Delta t')$$
$$y_0(\Delta t') = y_0(0) + A\sin(\omega_1 \Delta t') \qquad \text{(II - 2a)}$$

Motion of our δ-function over a spherical path in D-space requires coordinated changes in $\Delta k'_x$, $\Delta k'_y$ and $\Delta k'_z$ in terms of Δk_t starting with

$$x_0(\Delta t') = x_0(0) + A\cos(\omega_1 \Delta t')$$
$$y_0(\Delta t') = y_0(0) + A\sin(\omega_1 \Delta t')\sin(\omega_2 \Delta t')$$
$$z_0(\Delta t') = z_0(0) + A\sin(\omega_1 \Delta t')\cos(\omega_2 \Delta t') \qquad \text{(II - 2b)}$$

In all of the foregoing changes, the "river of time" flows in an unperturbed fashion while the undulation intervals for the other **k**-wave coordinate directions change in well-defined and specific ways to cause our δ-function to execute specific motions in D-space. It should be clear from the examples given that a recipe can be given for R-space undulation interval changes that will guarantee *any* type of δ-function motion wished in D-space.

Appendix III
Electrodynamic Forces for the Figure 5b Geometry

From our standard electrodynamics applied to the Figure 5b situation, one finds that the force $\hat{F}$ between the A and B half-spaces can be either attractive or repulsive depending on the dielectric properties of phase C relative to phases A and B and is quantitatively given by [27]

$$\hat{F} = \frac{\hbar\overline{\omega}}{8\pi^2 L^3} \qquad \text{(III-1)}$$

where $\hbar$ is Planck's constant ($\hbar = h/2\pi$) and

$$\overline{\omega} = \int_0^\infty \frac{[\varepsilon_A(i\xi) - \varepsilon_C(i\xi)][\varepsilon_B(i\xi) - \varepsilon_C(i\xi)]}{[\varepsilon_A(i\xi) + \varepsilon_C(i\xi)][\varepsilon_B(i\xi) + \varepsilon_C(i\xi)]} d\xi \qquad \text{(III - 2)}$$

Here, the ε_j are the dielectric permeabilities of the three phases as a function of internal EM wave frequency ν. Here, ε(ν) is a mathematically complex quantity ($\varepsilon = \varepsilon' + i\varepsilon''$) and its imaginary part is always positive so that it determines the dissipation of energy in the internal EM waves. In addition, ν is a complex variable and $i\xi$ is the imaginary part of the argument of ε; thus, ε ($i\xi$) is a real quantity which decreases monotonically from ε(0), the static dielectric constant. The main point here is that, even for isotropic phases, the interaction between phases A and B depends upon the size and properties of the intermediate phase C.

Appendix IV
Renovating Maxwell's Equations to Express Contributions from Subtle Domains

The classical description of Maxwell's equations is as follows:
Ampere's Law:

$$\nabla \times \mathbf{H}_1 = \nabla \times \nabla \times \mathbf{A}_1 = \nabla(\nabla \cdot \mathbf{A}_1) = \mathbf{J} + \frac{\partial \mathbf{D}_1}{\partial t} \qquad \text{(IV - 1a)}$$

$$\nabla \cdot \mathbf{H}_1 = 0 \qquad \text{(IV - 1b)}$$

$$\nabla \cdot \mathbf{D}_1 = \rho \qquad \text{(IV - 1c)}$$

Faraday's Law:

$$\mathbf{E}_1 = -\nabla V - \frac{\partial \mathbf{A}_1}{\partial t} \qquad \text{(IV - 1d)}$$

Here, $\mathbf{A}_1$, V, $\mathbf{H}_1$ and $\mathbf{E}_1$ are the magnetic vector potential, the scalar electric potential, the magnetic field and the electric field, respectively, while $\mathbf{J}$, $\mathbf{D}_1$ and ρ are the electric current density, the electric displacement and the electric charge density, respectively. The additional condition utilized in the solution of these equations is the Coulomb Gauge defined as

$$\nabla \cdot \mathbf{A}_1 = 0 \qquad \text{(IV - 1e)}$$

which is based upon a source-free condition for $\mathbf{A}_1$.

When one considers the robust, physical effects associated with directed human intention [2], the proposal has been made that they arise as a consequence of the subtle domains acting as a source of magnetic potential. Defining φ as an incremental increase in subtle domain potential associated with the specific directed intention, it is proposed that φ creates a magnetic vector potential increase $\mathbf{A}_2$ given by

$$\mathbf{A}_2 = \eta f(\varphi) \qquad \text{(IV - 2)}$$

Here, f is some as yet undefined functional form and η is a material parameter.

If we now define the total quantities as

$$\mathbf{A} = \mathbf{A}_1 + \mathbf{A}_2\,, \quad \mathbf{B} = \mathbf{B}_1 + \mathbf{B}_2\,, \quad \mathbf{E} = \mathbf{E}_1 + \mathbf{E}_2 \qquad \text{(IV - 3)}$$

the renovated Maxwell's equations become

$$\begin{aligned} \nabla \times \mathbf{B} &= \nabla \times (\mathbf{B}_1 + \mathbf{B}_2) = \nabla \times \nabla \times (\mathbf{A}_1 + \mathbf{A}_2) \\ &= \nabla(\nabla \cdot \mathbf{A}_1 + \nabla \cdot \mathbf{A}_2) - \nabla^2(\mathbf{A}_1 + \mathbf{A}_2) \\ &= \nabla(\nabla \cdot \mathbf{A}_2) - \nabla^2 \mathbf{A} = -\mu\left(\mathbf{J} + \frac{\partial \mathbf{D}_1}{\partial t}\right) \end{aligned} \qquad \text{(IV - 4a)}$$

$$\mathbf{E} = -\nabla V - \frac{\partial \mathbf{A}}{\partial t} \qquad \text{(IV - 4b)}$$

with

$$\nabla \cdot \mathbf{A}_1 = \nabla \cdot \mathbf{B}_1 = 0\,, \quad \nabla \cdot \mathbf{A}_2 \neq 0\,, \quad \nabla \cdot \mathbf{D}_1 = \rho \qquad \text{(IV - 4c)}$$

Since Equation (IV-4c) holds, Equation (IV-4a) can be put in the more useable form

$$\nabla^2 \mathbf{A} - \nabla(\nabla \cdot \mathbf{A}) = -\mu\left(\mathbf{J} + \frac{\partial \mathbf{D}}{\partial t}\right) \qquad \text{(IV - 4d)}$$

with

$$\nabla(\nabla \cdot \mathbf{A}) \neq 0$$