Fundamental Problems in Quantum Mechanics

Rarely have I enjoyed armchair polemics in science more than when reading the last issue of *Apeiron* in which eight distinguished authors directed their attention to defects of quantum mechanics. What is the common denominator between them? They all seem to dislike the idea that nature should be ruled by probability, and they are not alone in this. There is something else on which they and almost all contemporary physicists agree. They accept the reality of energy fields as developed by Maxwell, Lorentz, and Einstein. These fields are not to be confused with force-fields (and vector potential fields) which are mathematical tools for summing action-at-a-distance forces.

A few of us claim that energy fields are an ingenious invention of the human imagination which, in many ways, has been helpful to physics. At the same time it can be shown by simple experiments that these fields do not exist in reality. There is no such thing as mass-bearing flying electromagnetic energy between the conductors of a transmission line and all other electrodynamics devices using metallic conductors. Any high-school student can prove this on the kitchen table. All he needs are a few pieces of metal, a cardboard box, some aluminum foil and a car battery. My son Neal demonstrated the experiment at Oxford University. Details will be published in our forthcoming book *Newtonian Electrodynamics* (World Scientific, in press).

A number of experiments proving the same point have been published during the past 170 years. None are as difficult as the tests of distant quantum correlation. Once the old Newtonian electrodynamics has been absorbed by modern experimenters, they will have no difficulty in devising numerous new proofs of the non-existence of field-energy momentum.

The proposed flying energy between transmission lines either violates energy conservation or momentum conservation. This seriously questions the general validity of Einstein's law $E = mc^2$. The flying energy should produce the magnetic component of the Lorentz force, but there is a total lack of evidence for this mechanism. Electric power engineers have to fall back on "circuit theory" which, as we have shown, is in fact the Newtonian electrodynamics of Ampere, F.E. Neumann, and Kirchhoff. Numerous papers have been published on the subject. Quantum theorists either never saw them or looked the other way.

The publisher of *Newton versus Einstein* (P. Graneau and N. Graneau, Carlton Press, New York, 1993) sent review copies to fifty prominent North American physicists and asked them for comments. Only one replied. It turned out to be a Nobel Laureate. He agreed that the Lorentz force could not be explained with field energy impact. Rather than admit this publicly, he declined to review the book. We are still waiting for an onslaught which would demolish the credibility of our experiments. Can two years of silence be chalked up as a success?

If energy fields are not the handiwork of nature, then photons are equally doubtful. With them goes the wave-particle duality, at least as far as optics is concerned. There is no longer a need for the Copenhagen interpretation of quantum theory. Action-at-a-distance predictions, like the Aharonov-Bohm effect and distant quantum correlation, would be expected results of the Newtonian physics.

I can hear the cry of protest: what about time delays in the transmission of light? This is not an unsolvable problem in a Newtonian world. The beginnings of an explanation have been outlined in *Ampere-Neumann Electrodynamics of Metals* (P. Graneau, Hadronic Press, 2nd Edition, Palm Harbor FL, 1994), a book which in spite of the conspiracy of silence has gone to a second edition after having been in print for nine years.

A Newtonian quantum mechanics will make the same predictions about the outcome of experiments as the present field-based theory. This is the case because both theories would be built around the same empirical input data, rather than on hypotheses.

Peter Graneau
Centre for Electromagnetics Research
Northeastern University
Boston, Massachusetts, USA

More on Fundamental Quantum Physics

As a researcher in the fundamentals of quantum theory for over 40 years with a number of papers to my credit, the latest appearing in *Apeiron* (Wesley 1995), and author of the book *Causal Quantum Theory* (Wesley 1983), I would like to make a belated contribution to the Special Issue of *Apeiron* (Vol. 2 #4, 1995) on Fundamental Problems of Quantum Physics.

Copenhagen theory vs. local causality

The claims of Aspect *et al.* and others of having experimentally demonstrated the violation of Bell's inequality thereby confirming the Copenhagen theory and showing the failure of local causality are not warranted: 1) The EPR conditions necessary to test Bell's inequality cannot be fulfilled; because it is experimentally impossible to detect an individual *single* photon, and thus to observe correlations between individual pairs of photons from a single atom, as recognized by Santos (1995). 2) Aspect *et al.* improperly discard valid data as "accidental" in order to convert the classical physical optics result, actually observed, to the result predicted by Copenhagen "quantum mechanics" (Wesley 1994).

The Copenhagen theory, predicting a violation of Bell's inequality, requires "nonlocality," where causes are supposed to produce instantaneous widely separated effects without any physical mechanism being required. It should be noted that the claim of nonphysical cause and effect is also the basis of astrology, extrasensory perception, spiritualism, and other such beliefs. Since the many claims in the past of having observed nonphysical cause and effect have never withstood proper scientific scrutiny; the truth of the Copenhagen quantum theory would appear to be extremely unlikely.

The claims of Aspect *et al.* of actually demonstrating nonphysical instantaneous widely separated cause and effect are not justified; because their observations are readily explained by ordinary classical physical optics (Wesley 1994).

Since the observations of Aspect *et al.* are adequately predicted by classical physical optics; ordinary classical local causality is confirmed; and the Copenhagen "quantum mechanics" is not confirmed.

Hidden variables are unnecessary

The idea that the traditional Copenhagen quantum theory fits empirical observations that are necessarily intrinsically random leads to the erroneous idea that the Ψ function is not "complete" and that there must be additional variables, that are "hidden," which, if known, would permit precise prediction. But there is *absolutely no empirical evidence whatsoever for random quantum particle behavior*. All actual macroscopic observations are predicted precisely by classical wave theory, such as given by physical optics and sound, where the energy flow, the "Poynting vector," yields precise point particle motion as explicit functions of time along discrete trajectories, subject only to the initial conditions (Wesley 1983, 1995). In particular, if observables are defined in terms of the particle velocity $\mathbf{w} = \mathbf{P}/E$, where $\mathbf{P}$ is the Poynting vector and E the energy density, then all quantities of interest can be derived and known in principle, precisely in agreement with observations; so no "hidden variables" are needed.

If the artificial operator approach, the Hilbert space approach, observables as expectation values, probability amplitudes, single particle wave packets, the uncertainty principle, and other such untenable ideas of the Copenhagen theory are abandoned, then the Ψ function is "complete" and, at the same time, no "hidden variables" are needed.

The most important unresolved issue

Contrary to the Copenhagen quantum theory, which ascribes wave or quantum behavior to a single particle, wave and quantum behavior are empirically found to be ensemble effects involving many particles. The most important problem is then to discover the coupling between quantum particles that gives rise to the ensemble phenomena of waves and quantized modes. For example, what holds photons together in a source long enough for enough photons to accumulate to produce phase coherence? What then produces the sudden cascading of all of the photons in one burst lasting the coherence time? In other words, what are the ensemble forces producing the lasing action observed for all sources?

Future developments of foundations

Considering the fact that over the last 40 years my papers, differing from the Copenhagen theory, have been generally rejected for publication and considering the fact that only the Copenhagen theory is presented in textbooks and in the journal literature, I see a continuation far into the future of the same old Copenhagen theory with all of its numerous errors, its inconsistencies, its mysticism, and its miserable inability to predict most of the relevant precise experimental results.

If, however, some physicists were to realize that classical wave theory, as provided by physical optics and sound, must be fundamental quantum theory itself, that agrees with most of the available relevant empirical evidence, then the future brightens. The Poynting vector (Wesley 1983, 1995) for light and sound yields the exact behavior of photons and phonons. Quantized atomic states from standing wave modes are merely a necessary consequence of classical wave theory.

Quantum behavior is probably a derived effect, like van der Waal forces or sound, that does not involve any fundamental physics, except possibly spin involving $\hbar$. A modest stepwise empirical approach is the only sure future for quantum theory. The grandiose ideas, verging on delusions of grandeur, that characterize the Copenhagen school are not needed; they are only a hindrance.

References

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J. Paul Wesley
Weiherdammstrasse 24
78176 Blumberg, Germany

Copenhagen, Yes or No?

"When he said he was a philosopher I got up and left." This was at a physics symposium, said to someone, over coffee, concerning a paper I had just presented. Nor is it by any means the only example of its kind. For instance, at the same conference someone kindly advised me: "You shouldn't have let on you were a philosopher. If you hadn't done that, they'd have listened to you."

Some physicists, however, did stay—and listen, which is why I was glad to receive a copy of this journal and the suggestion that I should submit an article. So there must be physicists who are thinking about philosophy. This is plain, moreover, from the editorial, in the October 95 special issue of *Apeiron*, which states: "First of all, one should distinguish physicists who are basically pro- from physicists who are basically anti-Copenhagen." This is an essentially philosophical issue, and it would be surprising indeed if philosophers as such were excluded from participating in the dialogue.

However, from a philosopher's point of view, it seems strange that so many physicists treat the Copenhagen view of physics as though it were definitive of a certain kind of philosophy, whereas it was never, in fact, more than an amateur rendering of contemporary philosophy which Bohr sought to use as an underpinning for his physics. That bit of philosophy, even at its professional best (*i.e.*, with Ayer and Wittgenstein), was never more than a passing phase in philosophy proper, soon to be abandoned by its Vienna Circle creators, the Logical Positivists of the nineteen-twenties. This means that the tussle physicists are continually having with the question "Copenhagen, yes or no?" is like trying, by experimental means, to decide a simple yes or no answer to the old trick question, "Have you stopped beating your wife?"

Could it be, then, that the sorts of physicists who think in this way don't want the game changed? No doubt they feel they have captured the essential philosophical issue and neither know nor want to know what sorts of distortions Bohr, with his rendering of that kind of philosophy, might have introduced into theoretical physics, nor what has transpired in philosophy since. For those who are still with us, here, I shall tell the true philosophical story. It is that the roots of the "idealism" Bohr inaugurated into physics in the Copenhagen format had already been killed-off no less than twenty-five years earlier by the commonsense philosopher G.E. Moore in his famous (amongst philosophers) essay, "The Refutation of Idealism" [1]. Briefly, what Moore did was to demonstrate, logically and philosophically, what was to be corroborated in relativistic physics, twenty-three years later, by the scientist Gilbert Lewis (as will be shown in due course). This was that, fundamentally, there is no radical division between the material object and the observer, of the sort that leads to both idealism and its opposite, a truncated form of "realism." The existence of material things, Moore concluded, "has precisely the same evidence as that of our sensations." In other words, Moore was saying that the traditional "two worlds" of matter and commonsense-observation are, logically, one (albeit not coextensive in the way the idealists assumed).

Now that statement of Moore's, it was thought, could never hold outside philosophy, because in the "real" physical world some mediating agency always intervenes between the object and the observer such as, ultimately, light, which takes time to travel from the object to the observer in waves (or wave-particles). These can be delayed, distorted and so on, by intervening influences in all those ways known to the science of optics. And even in cases where all such mediating influences can be excluded, there remains the fact that for every metre of distance separating the object from the observer there are, at the very least, 3.3 nanoseconds of time, due to the "finite speed of light *in vacuo*." So how can the world of material objects and their physical interrelations be continuous with that of our sensations and their mental interrelations? They can't, physicists concluded; so the real world and the mental world are radically different, with radically different language-structures needed to describe them. Thus, in physics, we have the perennial tussle between the "realists" and "idealists" for the supremacy of their own particular choice of these radically distinguished "material" and "mental" worlds and associated language-systems.

It is therefore scarcely surprising that a Great Divide has developed between modern philosophy and modern physics. On the one hand there are the philosophers, who follow Moore in espousing "ordinary language" to describe the world that is real for them and, on the other hand, there are the physicists with their specialised "jargon" to describe what is real for them, as though that division of "realisms" were endemic in the nature of things. It is ironic that but for this Babelian split in language, it would have become clear, as far back as 1926, that Moore's logical argument that there is, fundamentally, no radical division between these "two worlds," which first appeared in the philosophical journal, *Mind*, was now corroborated by an article in the science journal, *Nature*. This was by the aforementioned Gilbert Lewis, who demonstrated, on the basis of special relativity, that at the level of the ultimate quantum nexus between object and observer the con-

tact is immediate and instantaneous regardless of what we perceive on the macroscale as distance [2].

Now Lewis' physics paper, of course, would not have interested philosophers any more than Moore's philosophical essay would have interested physicists, because by then Physics and Philosophy were well and truly divergent along those lines described. Nor, for the same reason, would it have been generally appreciated that this logical merger of the two "realisms" is, in principle, endorsed by relativity, in which the old categorical division between matter and observation disappears. In fact, however, that full synthesis is withheld by the persistence, in Einstein's version of special relativity, of his old-style-realistic interpretation of light as consisting of space-travelling "photons." Happily, then, Bondi has shown that special relativity need not be expressed in those "light-velocity" terms. Preferring the "radar method," he says [3]:

> *A beautiful feature of using radar to determine distance is that all talk about the velocity of light dissolves into nothing. You then measure distance by time. Any attempt to measure the velocity of light is therefore not an attempt at measuring the velocity of light but an attempt at ascertaining the length of the standard metre in Paris in terms of time-units.*

In that way, Bondi replaces Einstein's "light-velocity" with a distance-time conversion factor, which makes no difference whatsoever to the mathematics of special relativity—apart from making it very much simpler [4]. It does, however, make a profound philosophical difference, which is that Bondi's time-separation is relative—*e.g.*, zero for the light-quantum and 5*c* for the observer, as opposed to Einstein's "light-velocity" separation, which is absolute. This slight adjustment proposed by Bondi removes the final impediment to a full-scale natural synthesis of the findings of the philosophers and physicists regarding the instantaneous quantum nexus Lewis described between the "world of the observer" and the "world of material objects."

Perhaps that addresses at least the second part of what the editors of Apeiron define as

> *... the problem—past, present and future—of achieving a rational understanding of the microworld, and in particular, to present, in very general terms, thoughtful alternatives to the tortured vision bequeathed to physics by the Copenhagen school.*

The proffered alternative thus far described has its beginnings in the University of Wales and was developed to its present stage at Keele University in England. Called Normal Realism, it encapsulates the essence of the philosophy of Moore and his followers such as Austin, Ryle, the later Ayer and the later Wittgenstein, and its latest developments are as described in various publications of mathematics and physics [5]. (It will not have appeared in journals of practical or experimental physics, of course, because of the dichotomy already discussed, according to which publishers deem matters of philosophy irrelevant to physics.)

Perhaps, however *Apeiron* is different. So let us now address, from this post-Copenhagen standpoint, the part of the problem that should be of more specific interest to physicists, namely, that "of achieving a consistent, rational understanding of the microworld." What does our philosophical alternative offer to physics in that more practical direction? To another question posed in the Apeiron editorial, "What is the most important unresolved issue in quantum physics today?," Franco Selleri replies that in his opinion it "concerns the possibility of giving a rational description of physical reality" [6]. Well, certainly, there cannot be two realities in nature, so Moore's commonsense merging of these traditionally competing "realities" (as contrasted with the usual "bashing" of the one by proponents of the other) has to be at least a step in the direction of rationality. Rational also is the replacing of the old absolutist notion, that time ticks everywhere at the same rate both in matter and in empty space, by the relativistic conception of time being ticked by every distinguishable piece of matter individually—*i.e.*, separately. This disposes of any notion of a static and determinate geometrodynamical *continuum* or plenum (as in General Relativity). In its place it substitutes a quantum *discretum* whose mathematical, albeit statistical, features are similar to those of G.R. but whose only continuity is active (interactive) and kinematical, as befits the gradual shift in modern physics away from the old "analog" kind of physics into a digitalised, information-statistical mode. Rational also is the fact that although a light-signal is the fastest thing there is, and although it takes perhaps aeons to get from A to B, this presents no barrier whatsoever to the requirement that quantum interaction has to be immediate and reciprocal in accordance with both Newton's third law and the law of conservation. (Obviously, energy lost by an emitter cannot hang about inscrutably, perhaps forever, until it manifests itself by "hitting something.") The fact that a light-quantum is the element of this instantaneous interaction and that waves of these interactions travel at the finite speed *c* is all part of the same relativistic package, as Lewis has shown.

So there is no mystery whatsoever in what is called "instantaneous action-at-a-distance," since this is facilitated, not by "spooky superluminal agencies" but by light itself, in its own intrinsic or proper time as Lewis has demonstrated. Nor is it any mystery that the quantum elements of a light signal and the wave itself behave in different ways, the quanta being little instantaneous connections between atoms and the wave being observational sequences of these quanta. These sequences propagate in information-projected macrospace at the finite speed *c* with the purely probabilistic parameters of the Schroedinger wave-equation. A *wave*, anyway, is always a *kinematical* phenomenon. It is constituted of sequences of discrete events like, for instance, a water-wave, which is composed of little circular motions of molecules about a fixed point while the wave travels along the surface in an entirely different way with an entirely different speed. There is no logical case, therefore, nor any need—for the conception of "wave-particle duality" [7]. To regard a wave as a particle or a particle as a wave is to use language in an entirely illogical and confusing way, as though it referred to entities in some strange and metaphysical world-apart. And perhaps *that* is the root of the present problem in physics "of achieving a consistent rational understanding of the microworld." Maybe an unwarranted preoccupation with "Copenhagen," to the neglect of true philosophy, has allowed a weed-like proliferation of what the philosopher Wittgenstein called *Scheinprobleme*—that is, illusory problems created by sheer misuse of language.

Notes and References

1. G.E. Moore, in: *Mind, N.S. Vol.* xii, 1903. See also, G.E. Moore, *Philosophical Studies,* Routledge & Kegan Paul, London (1960).
2. G.N. Lewis, "Light waves and corpuscles," in: *Nature* 117 (1926).
   What Lewis demonstrated, in effect, was that the intrinsic or proper time of a light-quantum, which is the time the quantum registers relatively to itself, at "speed *c*" relatively to the observer, between an emitter and absorber at an observational distance *s*, is $t_{proper} = t_{relative}\left[1 - \sqrt{c^2/c^2}\right]^{\frac{1}{2}} = 0$ where $t_{relative} = s/c$, whence the distance of that passage, registered by the quantum is $s_{proper} = ct_{proper} = 0$.
3. *H.* Bondi, *Assumption and Myth in Physical Theory,* Cambridge University Press (1965) p. 28.
4. See N.V. Pope and A.D. Osborne, "A new approach to Special Relativity," *International Journal of Mathematical Education in Science and Technology,* 18:2 (1987), 191-198; also N.V. Pope, "Relativity is kids' stuff," *School Science Review,* 70:253 (1989) 86-87.
5. N.V. Pope and A.D. Osborne, "Instantaneous relativistic action-at-a-distance," *Physics Essays* 5:3, 1992, 409-419; N.V. Pope, "Relativity and realism" and "The holistic simultaneity of distant interaction," *Proceedings of Physical Interpretations of Relativity Theory (PIRT)* (1992) 512-537; N.V. Pope and A.D. Osborne, "Instantaneous gravitational and inertial action-at-a-distance," Physics Essays 8:3, 1995 (in press).
6. F. Selleri, *Apeiron* Vol. 2, Nr. 4 October 1995, page 112.
7. The fact that a particle has mass and a wave has mass (its energy $h\nu$ divided by c^2) by no means entails that the wave is a particle. In commonsense logic that would be like arguing that because an elephant has mass and a butterfly has mass, an elephant is a butterfly.

Neville Vivian Pope
'Llys Alaw'
10 West End, Penclawdd
Swansea, West Glamorgan, SA4 3YX
United Kingdom.

More on Problems of Quantum Physics

Vol. 2 No. 4 of *Apeiron* reveals that physics is in very deep trouble. The conceptual and mathematical complexity of Quantum Mechanics is a certain indicator that it does not describe reality. The alternative to QM does not lie in "hidden variables" but in developing a completely new concept of the micro-world based on the facts of nature. Serious scientists must go back to basics and critically re-examine the foundations of today's physics.

Rigorous, objective, and critical analysis of the origins of Special Relativity (SR), Planck's Quantum Theory (QT), and the Heisenberg Uncertainty Principle (HUP), will reveal that all are predicated on dubious assumptions and even more dubious algebra. SR is founded on incorrect algebra. Both of Einstein's two derivations of his "transformations" contain invalidating errors. QT conflicts with the well-proven Fourier Integral which says that it is impossible for a single pulse (wave-packet) of finite duration to be monochromatic. Planck became aware of this serious problem and unsuccessfully attempted to resolve it in his *Theory of Heat Radiation.*

The HUP reflects the non-commutative properties of matrices, not of physical parameters. According to Heisenberg, $dpdq = h/2pi$ (which is possible only if p or q is negative and imaginary) *only* when p and q are non-commutative. He does not tell us the circumstances under which that peculiar condition can exist in the real world.

The commonplace interpretation of deBroglie's WPD assumes that physical entities must be either "mass" or "waves" or both; ignoring the obvious possibility that they are neither.

Robert J. Hannon
4473 Staghorn Lane
Sarasota FL 34238-5626

Did the Universe Have a Beginning?

I am acutely interested in the subject matter of your paper published in *Apeiron,* Vol. 2, # 1, January 1995: "Did the Universe Have a Beginning?" My interest is especially directed toward your redshift hypothesis.

To recap: In that paper you offer several alternatives to the Big Bang theory as causes for an expanding universe. You suggest a cause for Doppler shifts (redshift) may be loss of photon energy which is not a consequence of source motion.

On page 23 You pose the question: What Else Can Cause Redshift? You offer an answer to your question: ."..Basically, anything that causes light (photons) to lose energy will cause redshift..."

This has significant implications for several well established concepts. Not the least of which is the Conservation concept. Special Relativity predicts that photon energy remain inversely proportional to photon wavelength. The Planck radiation concept requires that photon energy be given up or absorbed in discrete quantum units. Planck suggested that each discrete unit of radiation energy is in the form of a finite quantity of "energy elements." Planck also suggested that each finite quantum of "energy elements" is constrained to a finite "energy packet." The magnitude of each "energy packet" is a function of photon wavelength.

Based upon these conditions your argument is reconstituted: ... Basically, anything that causes photons to emit a discrete quantum of energy (elements) will result in decreased photon frequency. That decrease in frequency will require photons which lose energy and, simultaneously, increase their wavelengths as a function of the energy loss. Stated in terms relevant to Special Relativity and the Planck concepts: As photon wave lengths are Doppler shifted toward longer wave lengths a decreased amount of (photon) energy (elements) must, as a consequence of that energy (element) loss, be simultaneously redistributed over greater linear distance which is observed as Doppler shift.

Think of a hypothetical scenario where a photon source is stationary relative to the linear motion of a remote detection point. At the instant before detection begins the distance between source and detector is one light second. During a one second detection period the remote detector recedes from the stationary source at one kilometer per second. Assume that during a one second detection period the source emits (in the direction of the remote detector) $3*10^{10}$ one centimeter photons. During that one second the motion of the remote detection point increases the distance separating source and detection point by 100,000 centimeters. Each of the $3*10^{10}$ cm photons must increase (shift) their respective wave lengths so their linear distance is equal to: $3*10^{10} + 100{,}000$ centimeters. Or, where the motion of the detector is uniform each photon must increase its wave length by 3^{-4} cm. Such shifts in photon wavelengths must occur after those photons are emitted by that stationary source. This imposes the condition that the photon leading that wave front move slightly faster than light velocity.

This begs some questions: In this scenario, at what instant (during the one second detection period) would a discrete quantum of photon energy be "lost" by each of the photons? Do those discrete units of lost photon energy remain a coherent form of electromagnetic radiation? With respect for the conservation concept, to where should such energy be assigned? How do photon wavelengths increase (or decrease) in response to the motion of a remote detector *before being detected?* Do the photons in this scenario violate the light constant principle?

As you are no doubt aware there are several, highly successful, technologies in medicine, science, law enforcement and industry which have been developed for specific uses that are exclusively dependent on the Doppler effect. Do you believe that cosmological "redshift" is caused by mechanics different from Doppler effect mechanics?

I agree with you "..that one day we will discover the particle or wave serving as the carrier of the gravitational force..." When that discovery is made it must show conclusively how that force and all electromagnetic radiation traverse etherless space.

I am in the process of compiling an animated computer model of electromagnetic radiation. The attributes of that model are imposed by what is known about electromagnetic radiation: interference, diffraction, *etc.* One interesting attribute imposed upon the model comes from where a prism breaks up photons of "white light" into their spectral components. This is compelling evidence that each photon of "white light" is a polyphoton. Oddly, the solution to adapting the model to this phenomenon was rather simple.

Howard Hoover
25190 Gilbert St.
Hemet, CA 92543

...Tom Van Flandern replies

Thank you for your letter about my paper, "Did the Universe Have a Beginning?" (*Apeiron,* Vol. 2, No. 1, January 1995). In it, you raise some interesting questions.

In your letter, you said, "The Planck radiation concept requires that photon energy be given up or absorbed in discrete quantum units." In this context, it is important to put in all the qualifiers. The discrete quantum units you mention are not discrete units of energy except at a given wavelength or frequency. At another frequency the energy units are correspondingly larger or smaller.

Moreover, the discrete units affect the energy of electrons or other quantum entities as they emit photons, but do not affect the photons themselves. As photons gain or lose energy (for example, from the Doppler effect or from gravitational redshift), they do not do so in discrete quanta. Instead, frequency or wavelength changes as a continuous variable.

And energy (E) must then do the same because of the relation $E = hn$, where h is Planck's constant and n is the frequency.

For example, a spectral line in the light from a rotating source is broadened by an amount that reflects all the relative velocities between us and each part of the rotating source. The broadened line is not "banded," but continuous. There are no frequencies that are forbidden to a photon. By contrast, electrons in an atom can emit or absorb only certain discrete frequencies.

Therefore, the quoted statement above that premises your argument is not one I can agree with. Energy quanta are not applicable to photons, so such quanta do not

limit possible redshift mechanisms.

You also ask about energy conservation. One simple method of energy loss for propagating photons would be friction with another medium—for example, a hypothetical medium of gravitons. Then as the photons lose energy, the graviton medium gains it. Later, the gravitons give up their extra energy to electrons and protons as gravity forces them to form new atoms, that can emit new photons, continuing the cycle.

A common objection to photon energy loss in a medium is that known individual quantum particles would have such a large effect when colliding with photons as to result in blurred light or fuzzy images of distant objects. But that makes an assumption that known quantum particles are truly fundamental building blocks. If they are but another step in an indefinite chain of ever smaller constituents of substances, and if our hypothetical gravitons were, say, 20 orders of magnitude smaller than known quantum particles, no such objection would apply.

Although this explanation makes further examination of your example a moot point, let me remind you that the speed of light is the same for all observers. If a light source moves away from a fixed point at speed 0.9 *c*, and an observer moves away from the fixed point in the opposite direction at 0.9*c*, nonetheless the light source is still moving away from the observer at a speed less than *c*, as given by the Lorentz formula. In your example, you allowed velocities to add linearly, which is invalid in special relativity. So no wave fronts can move faster than *c*.

Tom Van Flandern
Meta Research Inc.
6327 Western Avenue NW
Washington, DC 20059

A Solution to the Solar Neutrino Problem

The standard solar model says that the sun produces energy by converting protons to alpha particles, essentially, hydrogen turning into helium:

$$4p^+ \rightarrow a + 2e^+ + 2n \qquad (1)$$

There are some major problems with this reaction. Several decades of experiments have found far fewer neutrinos than the standard solar model predicts (about one third the predicted amount). Reaction (1) produces two neutrinos for every alpha particle. It behooves us to find an alternative to reaction (1) with a lower production of neutrinos.

According to standard elementary particle physics, there are eight other ways to take four protons and produce alpha particle. Each of these reactions is essentially equivalent to (1):

$$4p^+ + e^- \rightarrow a + e^+ + 2n \qquad (2)$$

$$4p^+ + 2e^- \rightarrow a + 2n \qquad (3)$$

$$4p^+ + \bar{n} \rightarrow a + 2e^+ + n \qquad (4)$$

$$4p^+ + e^- + \bar{n} \rightarrow a + e^+ + n \qquad (5)$$

$$4p^+ + 2e^- + \bar{n} \rightarrow a + n \qquad (6)$$

$$4p^+ + e^- + 2\bar{n} \rightarrow a + e^+ \qquad (7)$$

$$4p^+ + 2e^- + 2\bar{n} \rightarrow a + e^+ \qquad (8)$$

$$4p^+ + 2e^- + 2\bar{n} \rightarrow a \qquad (9)$$

Now reactions (1)–(3) produce 2 neutrinos for each alpha, reactions (4)–(6) produce 1 neutrino for each alpha, and reactions (7)–(9) produce no neutrinos at all. The fact that less than one third the neutrinos predicted by (1) are observed would seem to indicate that reactions (1)–(3) are rarely, if ever, used by nature.

There is another problem in that all the reactions except (3), (6) and (9) produce positrons. If positrons were produced in the quantities these reactions predict, we would observe a radiation at 0.511 MeV, corresponding to electron-positron annihilation. No such radiation has been observed. These arguments indicate that only reactions (6) and (9) actually occur. By lucky happenstance, these are also the versions of the reaction which bring together the fewest positive charges.

But reactions (6) and (9) introduce another problem, instead of having a neutrino as output, they require an anti-neutrino as input. While this is a problem in standard cosmology, it is not a problem in the plasma universe model.

Paul Dirac won a Nobel Prize for his prediction of antimatter. Dirac concluded his Nobel acceptance speech (Dirac) with a conjecture:

> *If we accept the view of complete symmetry between positive and negative electric charge so far as concerns the fundamental laws of Nature, we must regard it rather as an accident the Earth (and presumably the whole solar system) contains a preponderance of negative electrons and positive protons. It is quite possible that for some of the stars it is the other way about, these stars being built up mainly of positrons and negative protons. In fact, there may be half the stars of each kind. The two kinds of stars would show exactly the same spectra, and there would be no way of distinguishing them by present astronomical methods.*

This model of the universe was developed by Hannes Alfven and Oskar Klein (Alfven and Klein 1962) and discussed in the books by Alfven (1966, 1981) and Lerner (1991). Klein's mechanism for separating matter and antimatter is described in terms of plasmas, hence the name, the cosmic plasma model of the universe.

The hydrogen burning process in the stars produces a sea of neutrinos. Stars made of anti-matter would produce a sea of anti-neutrinos to add to this sea of neutrinos and I have suggested (Love 1992) that the cosmic background radiation is due to neutrino-anti-neutrino annihilation. This sea of antineutrinos would account for the anti-neutrinos required to activate reactions (6) and (9).

Since the neutrino interacts so weakly and (9) requires twice as many neutrino interactions as does (6), it seems likely that (6) is the only reaction which occurs. Even with this reduction in the numbers of neutrinos produced to half that of (1), there are still not enough neutrinos observed. Again the sea of anti-neutrinos offers an explanation, since the stream of neutrinos from the sun would be seriously depleted by the time it reaches the earth due to interaction with the sea of anti-neutrinos.

The main point I want to make in this note is that some very basic physics has been overlooked in the attempted solutions to the solar-neutrino problem and that "ordinary solutions" should be thoroughly examined before extraordinary solutions are taken seriously.

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Thomas R. Love
Department of Physics
California State Univ., Dominguez Hills
Carson, CA 90747

Relativity of Lengths: Response to Wen-Xiu Li (*Apeiron* 2(3):93)

In his attempt to disprove my criticism (Wilhelm 1995), Wen-Xiu Li (1995a) misrepresents the contents of his paper (1995b) and introduces further errors. This forces me to set the record straight as follows.

1. Li's (1995a) confession, "Wilhelm *may be* correct that Li rediscovered paradoxes and criticisms originally due to Dingle and Essen ...," is hypocritical. When I commented on Li's lack of originality and failure to quote the original sources in earlier papers, I brought the relevant publications of H. Dingle, L. Essen, and others to his attention.

2. Li's (1995a) assertion that "theories of an ether [are] due to Newton and Maxwell" is false (Whittaker 1951: ether theories are due to J. Bernoulli, L. Euler, J. MacCullagh, W. Thomson, A.L. Cauchy, J. Larmor). Li's claim that Mach and others "refuted absolute space and time concepts" is an untrue *ad hoc* fabrication (Whittaker 1951). Rod contraction was first proposed not by H.A. Lorentz but by G.F. Fitzgerald (Whittaker 1951).

3. Li (1995a) is mistaken that his statement, "*Low temperature* (a scalar!) *contracts a rod,*" implies that *moving or resting* rods may

not be subject to forces from other bodies present and ether drifts.

4. In his paper, Li (1995b) introduces the 'axiom'(!): "*Taking into consideration the fact that a rod which is at rest relative to the Earth is simultaneously in various motions relative to other matter in the universe, it is reasonable to assume that the length of the rod is independent of its motion relative to any body. This assumption might be called the principle of the constancy of length.*" Li's (1995a) (i) denial that he made in (1995b) this untenable statement and (ii) assertion that he meant something else by it disclose lack of integrity.

5. Misrepresenting his paper (1995b), Li (1995a) claims that the principle of the constancy of the length of a rod moving or at rest relative to the Earth "means" that the rod length is independent of the velocity of the observer, and that his theory proves this. These claims are untrue and without basis since in Li's (1995b) theory (i) the observer is attached to the Earth, whereas (ii) the rod moves with *constant* velocity **v** relative to this observer!

6. In reality, Li (1995a) takes refuge in results from Wilhelm (1993a,b). In these (known to Li) and earlier (1991-1993) applications of Galilei (G) covariant electrodynamics (Wilhelm 1985), the length of a rod moving with a velocity **v** in an *inertial* frame (IF) S(**w**) (with ether of velocity **w**) is shown to depend on its *absolute* velocity $\mathbf{v}^\circ = \mathbf{v} - \mathbf{w}$ = G-invariant, *i.e.* is *independent* of the velocity of the observer relative to the rod.

7. Li's (1995b) principle of the constancy of the length of a rod moving or at rest relative to the Earth, a *non*-IF, is false. The Earth (rotating about its axis) and the rod rotate about the Sun, which rotates about the center of our galaxy, so that the rod experiences an ether flow with *periodically* varying velocity. The interaction of this ether flow with the Coulomb fields of the electrons and nuclei causes the rod to change its length *periodically* (Wilhelm 1993a).

8. In addition, Li's (1995b) 'axiom' is false, since a rod (moving or at rest relative to the Earth) rotating relative to the stars of the universe is subject to periodically varying gravitational forces and associated length changes. *E.g.*, a rod fixed at one end to a point of the Earth's equator and pointing in radial direction experiences periodic length changes in the gravitational force field of the Moon as the Earth (with rod) rotates about its axis.

9. Li's (1995a) statement, "*The principle of the constancy of length never meant that the rod does not undergo physical interactions,*" reveals once more breakdown of his logic and physics. *E.g.*, experiments show that a rod fixed at one end to the Earth and pulled (pushed) by a large force pulse at the other end will be elongated (shortened).

10. The length of a Li-rod (alleged by Li (1995b) to be independent of all bodies present and their force fields) is necessarily the same, no matter whether it is moving uniformly with a velocity **v** or at rest in an IF. In accordance with Wilhelm's (1995) Eqs. (1)-(3): $\ell(t) = \ell(0) = \ell(\mathbf{v} = 0) = x_{Bo} - x_{Ao} = \ell_o$, where x_{Bo} and x_{Ao} are the *fixed* initial coordinates of the rod along the *x*-axis of S. Li's (1995a) comment to the contrary is incompetent.

11. By standard (international) notation for algebraic equations, $x_2 - x_1$ is the distance of two points ($x_2 > x_1$) on the *x*-axis, whereas $x_1 x_2$ is the product of their coordinates. Li's (1995a) claims to the contrary reveal elementary ignorance.

12. Li's (1995b) theory of the length of the moving rod in the non-IF of the accelerated Earth is neither "correct" nor fundamental, since he did not consider the D'Alembert forces in his *accelerated* frame, and the interactions with ether and other bodies present.

13. Li's (1995a) conviction that absolute space and time and ether have been "refuted" indicates that he does not understand that he denies the very existence of the physical foundations of his attempted criticisms of Einstein in his *Apeiron* and *Physics Essays* papers. If there were no electromagnetic and gravitational field carrier (ether) and no distinguished IF S° (in which the cosmic ether excitations are isotropic), then indeed Einstein's special relativity theory would be physically acceptable.

Li's excuse that he is justified in republishing the ideas of Dingle and Essen since (allegedly!) Wilhelm did not quote Newton in his publications (which deal with applications of G-covariant electrodynamics, based on the existence of an IF S° in which the ether and cosmic microwave background are at rest) is unethical. Is it really necessary to quote Newton in Wilhelm (1993a), "Fitzgerald Contraction, Larmor Dilation, Lorentz Force, Particle Mass and Energy as Invariants of Galilean Electrodynamics"?

A literature search indicates that Li already made ample use of this self-serving excuse in 1994. *E.g.*, Li (1994), "On the Galilean Relativity of the Laws of Electrodynamics," rediscovers the electrodynamic equations for moving bodies of Lorentz (1895) under his own name without quoting Lorentz. The physical misunderstandings in this publication are so numerous that I can not comment on them here (*e.g.*, Li does not comprehend that the Lorentz/Li equations are not G-covariant; even one of his underlying Maxwell equations for resting bodies is flawed).

For reasons of space, not all errors in Li (1995a,b) could be discussed. However, it must be noted that Li (1995a) made a nearly correct statement, namely that he is "a relative unknown." The International Science Citation Index confirms this *relatively* and *absolutely*.

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H.E. Wilhelm
Thermopolis, WY 82443
USA

The "Black Hole": Superstition of the 20th Century

The issues related to the "black holes" have been receiving ample publicity. I think it reasonable to mention two recent efforts. Robert L. Carroll [1] considers that a black hole, as an imaginary object in cosmology, does not exist in the real Universe. On the other hand, P.F. Browne [2], understanding a black hole as a reality, extends this notion to the whole Universe. Who is in the right? The question requires clarification as to the origin and the essence of the "black hole."

The Theory of Relativity is based on two principles, and one of them forbids motion at superluminal velocity. To comply with this condition, it was assumed that the gravity action propagates at the velocity of light. The General Theory of Relativity (GTR) is based on this assumption. The interactions between bodies under GTR are considered in the form of distortions of four-dimension space-time. This method conceals the essence of the results obtained under GTR. We shall consider interactions with the help of a method of forces providing conspicuous results.

In my works, for example in [3], it is shown that the finite velocity of action in case of interaction between two charges q_1 and q_2 in Gauss's system of units will provide the following expression for force:

$$\vec{F} = \frac{q_1 q_2 \left(1 - b^2\right)\vec{r}}{e\left(r^2 - \left[\vec{b} \times \vec{r}\right]^2\right)^{3/2}}, \qquad (1)$$

where $\vec{b} = \vec{v}/c_1$ is standardized velocity, $\vec{v}$ is a motion velocity of one object relative to the other; $\vec{r}$ is a distance between the objects; $c_1 = c/\sqrt{em}$ is a velocity of action propagation in a medium; c is velocity of light in the vacuum; e and m are dielectric and magnetic permeabilities of the media. In the vacuum $e = m = 1$ and $c_1 = c$.

With small charge velocity v the force (1) coincides with Coulomb's law but as the velocity increases the force decreases and as it approaches the velocity of electromagnetic action propagation ($b \to 1$) the force tends to zero, *i.e.* no action is exerted on such a body and it is not accelerated.

These two limit cases for the force are determined by the finite velocity of action.

According to the method of forces the mass of a body is independent on the velocity, *i.e.* is constant. It is the force that depends on the velocity. Under this method space and time are also independent on the velocity, so Lorentz transformations of coordinates and time are not used. All forms of interaction are considered on the basis of classical mechanics, the force alone depends not only on the distance between interacting objects, but on the relative velocity as well. Other researchers have also come to this opinion. For example, Xu Shaozhi and Xu Xiangqun [4] suggested that the expression for the force be written in the following form:

$$\vec{F} = \vec{F}_o f(b), \qquad (2)$$

where $\vec{F}_o$ is the force at interaction of motionless objects, as is the case of the charges interaction under the Coulomb's law; $f(b)$ is the coefficient dependent on the standardized velocity b that has limit values of $f(0) = 1$ and $f(1) = 0$. In our case the coefficient is

$$f(b) = \frac{(1-b^2)}{\left(1-\left[\vec{b}\times\vec{r}/r\right]^2\right)^{3/2}}, \qquad (3)$$

If we consider the gravitation action to propagate with the final velocity c_1, as is assumed under the General Theory of Relativity, expressions (2) and (3) present the force of the gravitation action, where

$$\vec{F}_o = -G\frac{m_1 m_2 \vec{r}}{r^3} \qquad (4)$$

is Newton's law of universal gravitation.

If force in (1) or in (2)-(4) is applied to each of two interacting bodies, then, in accordance with the second law of mechanics $m\frac{d^2\vec{r}}{dt^2} = \vec{F}$, after transformations we obtain:

$$\frac{d\vec{r}}{dt^2} = m_1 \frac{\vec{r}(1-b^2)}{\left(r^2 - (\vec{r}\times\vec{b})^2\right)^{3/2}}, \qquad (5)$$

where interaction constant m_1 in the case of two charges is

$$m_1 = \frac{q_1 q_2 (m_1 + m_2)}{e\, m_1 m_2}, \qquad (6)$$

and in the case of two interacting masses is

$$m_1 = -G(m_1 + m_2). \qquad (7)$$

As a result of the solution of Eq.(5) I obtained [5] a trajectory in the polar system of coordinates (j,r) as follows

$$j = \int \frac{h\,dr}{r^2 v_r}, \qquad (8)$$

$$v_r = c_1\sqrt{1-\frac{h^2}{c_1^2 r^2}} - \left(1-\frac{v_{ro}^2}{c_1^2}-\frac{h^2}{c_1^2 r_o^2}\right) \times \sqrt{\exp\left(\frac{2\cdot m_1}{c_1^2}\left(\frac{1}{\sqrt{r^2-\frac{h^2}{c_1^2}}}-\frac{1}{\sqrt{r_o^2-\frac{h^2}{c_1^2}}}\right)\right)}, \qquad (9)$$

where v_r is the radial velocity; v_{to}, v_{ro} are the transversal and radial velocities at the radius r_o; $h = v_{to}\cdot r_o = v_t \cdot r = \text{const}$. is the kinematic angular momentum which is constant for all points of the trajectory.

In my book [5] it is shown that at $c_1 \to \infty$ the expression for the radial velocity (9) converts to the classical:

$$v_r = \sqrt{v_{ro}^2 + 2\cdot m_1\left(\frac{1}{r_o}-\frac{1}{r}\right) + h^2\left(\frac{1}{r_o^2}-\frac{1}{r^2}\right)} \qquad (10)$$

In GTR, the gravitational field equation is solved approximately by way of expansion with retained terms in c, with order no higher than c^2. Then retaining the same terms in equation (9) and substituting (9) in equation (8) we obtain the equation of motion for the symmetrical, central force field of gravity, which is used in GTR :

$$j = \int \frac{h\,dr}{r^2\sqrt{c_1^2 + v_o^2 - (c_1^2 + h^2/r^2)\left(1-r_g/r\right)}} \qquad (11)$$

where $r_g = 2\cdot m_1/c_1^2$ is the gravitational radius.

Equation (11) and similar results describe the effects of GTR: the precessions of planetary perihelia, deflection of star light by a gravitational mass, and the existence of gravitational waves.

GTR describes the gravitational interaction as space distortion. I describe these interactions in terms of force (2)–(4). I would like to remind my readers that Nature is one, but the ways to describe it are numerous.

These two ways are based on one and the same assumption that gravity propagates with the finite velocity c_1. The difference lies in the fact that my solution (8)–(9) is precise, and solution (11) is approximate.

Now let us look at "black holes" with the help of the precise description. If a particle moves along the radius, *i.e.* $h = 0$, its radial velocity, according to (9), will be

$$v_r = c_1\sqrt{1-\left(1-\frac{v_{ro}^2}{c_1^2}\right)\exp\left(r_g\left(\frac{1}{r_o}-\frac{1}{r}\right)\right)}. \qquad (12)$$

Let a particle, for example photon, have a velocity $v_r = c_1$ at the point $r = r_o$. Then as follows from (12) its velocity at any other point is equal to:

$$v_r = c_1, \qquad (13)$$

i.e. the particle goes on moving with the velocity of light. That should happen just so! If the action generated by an object propagates with the finite velocity, the object cannot produce any action on another object moving with the same velocity.

So, if the gravitation action propagates with the velocity of light, light will be freely radiated by a star regardless of its mass. The star will shine brightly on the sky, and no "black hole" exists.

We come back to the question "Who is in the right?" My positive judgment is definitely with R.L. Carroll. There are no "black holes" at all. "Black holes" are a superstition of the 20th century.

A lot of questions arise in this respect. Which researcher was the first to invent this superstition? Is it harmless? Should a researcher be called to account for his mistakes?

The state of science determines the state of society. Contemporary physical sciences have given man an imaginary world. Men live in it and operate on unreal images. So in everyday life, men also dwell on imaginary, unreal values. This presents the worst conceivable danger for man, barring separate threats such as nuclear war, AIDS, ecological catastrophe and others.

Science is whatever provides knowledge. The history of science should discriminate between those who give knowledge and those who create superstition. To each according to his merits!

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Joseph J. Smulsky
Institute of Earth's Cryosphere
Siberian Branch Russian Acad. of Sciences
625000, Tyumen, Box 1230, Russia

Correction:

In the October 1995 *@ issue* section (*Apeiron* 2:124), the reply by G. Galeczki to H.E. Wilhelm was inadvertently truncated. Below we reproduce the portion of Dr. Galeczki's letter omitted earlier.

The "Aarau Question" and the de Broglie Wave: reply to Dr. Wilhelm

Dr. Wilhelm qualifies as "banality" the following quotation from the late Petr Beckmann's book *Einstein Plus Two.* "The recognizable velocities in electrodynamics are: the velocity of a charge in a magnetic field, which occurs in the Lorentz force, and the velocity of charges forming a current...." He ignored, I suppose deliberately, the following sentence: "These velocities do not produce physical effects simply by virtue of their definition with respect to an 'observer,' just as a windmill will not start to rotate because an observer starts running with velocity *v* relative to the mill...."This very sentence sheds light on a basic error of special relativity, namely, the dependence of "relativistic effects" on observer-referred velocities. (*N.B.* the "observers" are by no means interacting with the physical systems under study.) Honourable textbook writers such as J.D. Jackson, W.K.H. Panofsky and M. Phillips do not state explicitly what the velocity "*v*" in $\vec{F} = q\left[\vec{E} + \vec{v} \times \vec{B}\right]$ is relative to, so the problem is far from being trivial.

G. Galeczki
Fuldaer Str. 90
Köln 51103, Germany

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