the general science journal

Truth and Physics ~ A Critique

Extracted from "A General Philosophy"

home@wbabin.net

The following is an analytic assessment of physics presented from the standpoint of philosophy. This may not appear to be an exceptionally strong recommendation given the current state of the latter discipline, but it should be understood that all theories, including those of physics, are expressed within the context of a general world view or prevailing philosophy. This philosophy plays a significant role in our interpretation of physical events even though its tenets are for the most part, tacitly assumed. They are ingested with our mother's milk, reinforced by an essentially Pavlovian process of education(1) , and continually absorbed through contemporary literature and all other forms of human expression. As David Hume observed, our beliefs have more to do with sentiment, custom and habit(2) than any deterministic imperatives.

Because our philosophies exist mainly as unconscious content, they are rarely subjected to analytic scrutiny. They therefore exert an even more powerful influence over us. I do not mean to say that we are not conscious of philosophical systems of thought in general, but tend to view them more in the abstract sense, as an intellectual exercise rather than in the practical terms of how they affect our actions. We are not aware of the patterns that impose themselves on our work or our play(3) and it is in the contemplation of these patterns that one begins to appreciate the Hegelian concept of the "world spirit"(4) and its prevailing influence over our actions and our views.

As a result of the foregoing, one often finds the unconscious personal attitudes and convictions of an individual or a group attributed to abstract or transcendental concepts; a process that Jung refers to as projection(5) . This is a method of objectifying our attitudes and beliefs and endowing them with universal significance. Concepts such as freedom, love, country and the like, are often catch-basins for psychic content. For example, when Albert Einstein says "God is subtile, but not malicious" it is more likely that he is providing a self-portrait rather than one of the Deity. Much of our accumulated knowledge is of this type, where the expression of a personal belief is given by an authoritative image, disseminated, and over a period of time, generally accepted as truth.

Prevailing philosophies, whether conscious or unconscious, are not universally followed and one may find proponents of all modes of thought in any given epoch. Different segments of a society may simultaneously hold diverse views. These segments often further diverge until one reaches the personal level. Each level is modulated to some degree by all preceding so that it is often difficult (and probably impossible) to find expression of any one philosophy without elements of others. Also, various beliefs interpenetrate to such a degree that, in a general sense, distinctions of the type between philosophy and physics become superfluous. It is therefore more accurate to speak in terms of degrees and tendencies towards one system of beliefs or another that are present in all disciplines, both singly and collectively.

While we have become aware of recurrent themes and their archetypal aspects in literature, in allegory and in myth, the same insight has not been applied to our philosophical systems. As a result, they are continually re-invented within a new verbal guise and widely touted as the new philosophy, the new physics, the new art

form. In fact, there has never been a concept without an historical precedent. It would be instructive to enumerate the number of ancient concepts that we have incorporated into modern thought. One will find that all current theories are expressed within these pre-conceived philosophical frameworks. We may also be assured that antecedents to all written theories would be found in the verbal traditions of every society.

As an example, the current probabilistic view of the universe has found eloquent expression in the writings of Democritus[6] and the Epicurians where the formation and destruction of innumerable worlds is seen as the "fortuitous movements of atoms."[7] With respect to verbal traditions, consider how much the "big bang[8] " theory owes to the ancient mythological concept of the primordial egg.

The mere fact of the recurrence of the basic philosophical themes is indication that they have never been refuted. Each attracts its adherents, becomes the prevailing view, then gives way (more often than not) to its polar opposite. Since each can be supported by an infinite number of arguments and no conclusive superiority of one over the other has ever been proven, they must be given equal probability of being true. It therefore follows that any physical event can be interpreted from the standpoint of any philosophy with equal verity.

For example, the short history of modern physics (or natural philosophy) had been dominated by a rigidly deterministic viewpoint until the early part of this century[9] . It then changed to one that is highly probabilistic and romantic; one could say mystical. It became something of a fashion for leading physicists to quote, if not become proponents of, eastern mysticism[10] . We now speak of orders of magnitude, waves of probability, complementarity, matter waves, supra-dimensionality, relativism, curvature of space-time and indeterminacy. Few will question that the universe contains much that is mysterious and uncertain and few will argue that 20th century physics doesn't work. But determinism also works! In fact, it is difficult to conceive of an operational theory that does not contain elements of both principles.[11]

It is contended that an extreme position has been reached in contemporary theories when we speak in terms of all matter concentrated into a dimensionless point, of black holes, and the attempt to equate the ultimate constituents of matter with 10 or 11 dimensional strings. It is further contended that there is absolutely no difference in such concepts and the ruminations of philosophers of the middle ages who agonized over the number of angels that could dance on the head of a pin! Whether qualitative or quantitative, each represents a curious intellectual tangent to our collective view of reality. Their appeal may be attributed to the observation that nothing impresses us more than what we do not understand. Speculative theories of this nature usually indicate that the current philosophical system has reached its zenith and its influence is beginning to wane. However, we cannot say the theories are not true.

We may argue that theories in physics are true since the findings are verified by experiment. Physics is often referred to as an experimental science although its dependence on a conceptual model is obvious. Unfortunately, any experiment, when performed under the same conditions, will produce exactly the same result. Another way of saying this is that everything works, although it may not work the way we wish.

It should be very evident that it is not the experiments that are in question, but the interpretations and theories extracted from them. The "Copenhagen Interpretation" of quantum mechanics would suggest that a theory is true if experiment consistently produces the results predicted[12]. Yet equivalent results might be gotten by entirely different means[13] ! In this case, we could hardly call one method true and ignore the others. Similarly, we cannot call one theory a universal law and exclude competing theories which produce the same result. The theories themselves inherently contain much that is hypothetical and are therefore subject to many interpretations. It is not impossible to find underlying principles within a given theory that are in diametric opposition to one another.

These observations are given succinct expression in the old adage, "there are many ways to skin a cat." On

the intellectual plane, this simple concept is raised to the status of a philosophy with the somewhat inflated title of Ontological Relativity. This merely restates the Kantian dictum that all first (metaphysical) principles can be neither proven nor disproven. The Kantian view parallels many aspects of the philosophy of David Hume, which brings us back to a dependency on custom or habit and equates truth with a particular set of prejudices.

An experiment may be used to justify a theory, or the theory may be developed to explain an experiment. There is a danger in using the latter method since the predictions of the theory become self-fulfilling. It interprets the results of the experiment as irrefutable proof of its own veracity.(14)

The former method also has its dangers. For example, a person believing in divine intervention would notice a direct correspondence between worshipers bowing towards the east, and the rising of the sun from that direction. Such a theory could not be refuted on the strength of that evidence alone since experiment is out of the question. Somewhere, there may be someone bowing to the east. Obviously the fallacy in this, as in the other approach would be the inability to incorporate broader generalizations and/or the logical inconsistencies which would ensue when such are attempted.

Along with the strong faith in experiment, I think it a generally accepted (if unspoken) belief that a physical theory must be expressed mathematically; that physics is a mathematical science as well as experimental. The fact that modern theories are presented in this manner may indicate a superiority over their ancient counterparts. In the words of Bertrand Russell(15) , "Mathematics possesses not only truth, but supreme beauty...sublimely pure, and capable of a stern perfection such as only the greatest art can show." If this is true, we have indeed found the yardstick whereby all things can be measured(16) . Our questions must now be:

a. What is mathematics?

b. How is it that mathematics is pure and perfect when we have found nothing else that can make this claim? (17)

c. How does it relate to the phenomenal world?

In order to answer the first question, we might poll the commentators on mathematics throughout history only to find we have a collection of attributes associated with the subject, but few definitions. This is no doubt the reason we find Bertrand Russell admitting that "We don't know what mathematics is" or J. Von Neumann observing "In mathematics you don't understand things, you just get used to them." Perhaps a more successful approach would be to limit the scope of our inquiry to one aspect of mathematics, such as a definition for numbers. According to Russell, "The number of a class is the class of all those classes that are similar to it" also, "A number is anything which is the number of some class".(18)

At best, this is an expression of Platonism. At worst, it is tautological. The appeal to Plato is evident in the use of the word "similar". This signifies a slight difference to be found in classes of the same number, (presumably,) which are in some way related (presumably) to the phenomenal world.

The Platonic interpretation is widely (if tacitly) accepted for numbers and for mathematics in general. This is evident in the schism between "pure" and "applied". It is also the principle explanation given for their perfection. Unfortunately, this leads us to the fundamental dichotomy in philosophy; that of the ideal versus the real, or mind versus matter. Here we are faced with a transcendental universe of the mind where, by logical extension, each deviation from the ideal in the real world is also represented by an archetype. This only serves to give us a system of perfect imperfections.

The philosophy of Plato also contains the most broadly accepted answer to the third question. I will quote

two leading exponents of this view. "Pure mathematics consists entirely of assertions to the effect that if such and such a proposition is true of anything, then such and such another proposition is true of that thing. It is essential not to discuss whether the first proposition is really true, and not to mention what the anything is of which it is supposed to be true...Thus mathematics may be defined as the subject in which we never know what we are talking about, nor whether what we are saying is true."(19)

"As far as the laws of mathematics refer to reality, they are not certain; as far as they are certain, they do not refer to reality."(20)

To this point, we have found no reason to assume any advantage in the use of mathematics to express a physical theory. The view expressed in the last quotations suggests that we should not even bother! Fortunately, Platonism is not the only attempt to explain mathematics. Its precursor, the Pythagorian view, gives mathematics a decidedly numinous interpretation; a representation of the world as number, even to the exclusion of the real. One might think there would be no practical use for this approach since it denies precisely what it is supposed to explain, - and one would be wrong.

The current mystical outlook in physics provides fertile ground for just such an approach. It underlies a strong tendency to attempt resolution of physical problems through an abstract mathematical formalism. Heisenberg might be considered one of the leading proponents of this method, and it is partly in reaction to his extreme position that E. Schroedinger was led to his wave equations. Even here we must comment that "waves of probability" are hardly an improvement. Also, Minkowski and Max Born's attempt to provide Relativity theory with "abstract" coordinates(21) has a decidedly Pythagorian ring as well as being paradoxical.

Abstraction does not end with the "real". Numbers themselves are subject to the same device and in physics we are often left with a prevalent and obscure symbolism; an arcana expressed in a language understood only by the adept. To give only one example, "A function is said to be an eigenfunction of an operator if the effect of the operator acting on the function is to give a constant - the eigenvalue - multiplying the function."(22) If Lord Kelvin(23) is to be believed, this approach says a great deal about mathematics and very little about physics.

There is one other tendency which must be considered. While it has broader implications, there is no doubt that it gained prominence through the belief that physics is indeed a mathematical science. Here we give expression to it through a quotation by D. Hilbert: "... a mathematical problem should be difficult in order to entice us,... It should be to us a guidepost on the tortuous paths to hidden truths, ultimately rewarding us by the pleasure in the successful solution." This represents a definite bias towards the complicated and the obscure as difficulty is equated with truth(24) . (I think it probable that most scientists would concur with the observation that the universe is complicated, while referring to it in the singular.)

One can understand the general viewpoint of a mathematician since there is no challenge in resolving simple equations. Higher mathematics, to a mathematician means better and better means more complicated. However, when coupled with an excessively abstract perception of reality and applied to physics, it serves only to make the unintelligible, totally incomprehensible. This is no doubt what caused P. Dirac to exclaim about quantum mechanics, "Nature certainly does not have her ideas described in such a clumsy and ugly way. There is probably some neat solution which is yet to be discovered." The "complicated" gains full perspective in multiplicity. In its view, to generalize is to give expression to all known data in an attempt to encompass infinity. The "simple", in an attempt to generalize, will unify all data and ultimately say nothing.

Theoretical problems are not resolved with the use of mathematics; they are equated. All things equate in one way or another and it is the theory which selects. A theoretical relationship is assumed between objects or actions and tested through mathematical representations. Thus, mathematics is dependent on the **a priori** assumptions and selective processes associated with any given theory and is also subject to the same number

of interpretations.

This was expressed by Descartes - "When I was younger, I had studied a little logic in philosophy, and geometric analysis and algebra in mathematics, three arts or sciences which would appear apt to contribute something towards my plan. But on examining them, I saw that, regarding logic, its syllogisms and most of its other percepts serve more to explain to others what one already knows"...[25]

Nothing new is posited by mathematics. Its purpose is to subject any physical theory to analysis by checking for an internal logical consistency. As a language, it is often a concise and practical method of communication.

In order that a theory may accurately reflect a physical process, and that mathematics may be used to test the theory, it is essential that they all follow the same laws.[26] Otherwise a corroborative appeal to one or the other cannot be made! For an example; the law of excluded middle, the syllogism and the law of mechanical logic must be one and the same. Russell and Whitehead have fused the former two.[28] I propose the third be added by default. This allows us to state that if the phenomenal and noumenal occupy separate universes, the law transcends both! Unfortunately, in the purest sense, this unification of the three laws also becomes a restatement of the law of excluded middle which is, in itself, tautological. Therefore, a mathematical or verbal expression of a physical event proves nothing, and we are back where we started.

Summary: There is no doubt that 20th century pragmatism, relativity and probabilistic tendencies have led to a degree of intellectual nihilism and paralysis. (Since any supposition may take on the mantle of an imperative, we must accept many - or none.) The excessively deterministic attitudes of the preceding epoch led to a similar stagnation. A resolution of these, as well as other perennial conflicts cannot be made within the confines of this study but I will conclude with a few observations.

I know of no experiments which can lay claim to "ultimately" or "absolutely" proving anything. Such concepts belong in the area of metaphysical speculation. For example, there is no known experiment which will determine the geometry of space. Primitive concepts such as space, time and mass derive their meaning from the tenets of a particular theory. We do not know what they are in any ultimate sense. We have only standards that are unambiguously defined within the framework of the theory. It is the theory which determines the meaning. Within any theory, if it is given that one element is constant, all dependent elements must vary. In this respect, absolutes are only absolute by definition.

In our constant swings from one extreme to the other, we are merely stirring the soup rather than savoring the flavour. Mathematics, geometry, physics, music, dance, literature, and all expressions and endeavor, human or otherwise, are all equal representations and equal aspects of reality. Simultaneously, they are abstracts in that they are contained by, and contain the real. It is in the eternal character of the vast archetypal systems that underlie this inclusive "reality" that the answer is to be found. In contemplation of these, we may begin to understand the protean dynamics of creation itself.

Walter Babin

March 23, 1989

1. Mephistopheles, "First the **collegium logicum**. There will your mind be drilled and braced as if in Spanish boots 'twere laced." J.W. Von Goethe, Faust, p65, Modern Library.

2. Enquiries Concerning Human Understanding, Oxford University Press, P42-43.

3. Can it be that all the great scientists of the past were really playing a game, a game in which the rules are written not by man but by God? J.L. Synge, quoted by Coxeter, Introduction to Geometry, p77.

4. "...it can be said of world history that it is the description of the spirit as it works out the knowledge of that which it is in itself." Hegel, The Philosophy of History, Modern Library, p11.

5. "For as a rule, the unconscious first appears in projected form." etc. etc. C.G. Jung, Psychology of the Transference, Basic Writings of C.G. Jung, P417, Modern Library.

6. Certainly the atoms did not post themselves purposefully in due order by an act of intelligence, nor did they stipulate what movements each should perform. As they have been rushing everlastingly throughout all space in their myriads, undergoing a myriad changes under the disturbing impact of collisions, they have experienced every variety of movement and conjunction till they have fallen into the particular pattern by which this world of ours is constituted. On the Nature of Things: Greek and Roman Philosophy After Aristotle, Free Press.

7. St. Augustine's words. City of God, P349, Modern Library.

8. I would not dwell on the coincidental verbal similarities to the procreative process, but observe that only resolution of that profound philosophical problem of the priority of chicken or egg would determine whether the universe started with a whimper - or a bang. It is often one finds in the common idiom things more profound than in all the solemn ejaculations of the philosophers.

9. Even so. Kepler dabbled in numerology, Newton did research in astrology and many attempted pseudo-scientific interpretations of the biblical account of Genesis and Revelations. Napier, for one, was convinced that logarithms contained some expression of the latter. One cannot banish the qualitative any more than the quantitative

10. See quotations by J.R. Oppenheimer, Neils Bohr and W. Heisenberg in Fritjof Capra's book, The Tao of Physics, P16, Fontana Press.

11. In the Special Theory, we have the relativism of space-time but must also deal with a "proper" space-time within an inertial system. The euphemism does little to hide the infrangible and therefore, deterministic character of the concepts.

12. This is the pragmatic view which states that something is true because it works rather than the deterministic one; that it works because it's true.

13. "In the scientific method agreement with experiment has an absolute priority in judging theories, but cases can easily occur that may leave matters unsettled. Two theories may give essentially identical results... Roy Ringo, Complexity and Understanding, Physics Essays, March, 1990.

14. This is the case with the Special Theory of Relativity.

15. Mysticism and Logic, London, 1919, P241.

16. This is to be understood both literally and figuratively.

17. What definition can we give to the conservation laws, particularly the conservation of charge? They are considered infrangible, as is local space and time; not to mention the velocity of light.

18. Bertrand Russell, Introduction to Mathematical Philosophy.

19. Bertrand Russell, Mysticism and Logic, p75,76.

20. Albert Einstein.

21. " This invariant or "absolute" coordinate system is thus highly abstract." Max Born, Einstein's Theory of Relativity, P239.

22. Principles of Modern Physics, Holden Day, P164.

23. "I often say that when you can measure what you are speaking about, and express it in numbers, you know something about it...

24. It is not surprising that Hilbert was the discoverer of a geometry of infinite dimensions.

25. Discourse on Method, Discourse 2, p40, Penguin Books

26. Here "law" is not necessarily defined as absolute.

28. Principia Mathematica.