

On the Equivalence of Matter to Energy and to Spirit

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Abstract— *A basic assumption in logic is that the principle of equivalence formulates a relation among three terms. Yet, there is no recognized third term in physics that completes the established relation of equivalence between matter and energy. This paper suggests that the third term to which both matter and energy are equivalent can be posited to be spirit. Spirit is defined both as the link—as glue—that holds matter and energy together and as Spirit, a notion that is akin to the spirit of God, which is by definition everywhere. All three terms might eventually be measured by a calorimeter. If this application of the principle of equivalence is accepted, physics is transformed from a linear into a relational discipline. And then everything will change in the “two cultures”, namely in both the physical and the social sciences.*

Index Terms— *Equivalence, equivalence of matter to energy, equivalence of matter to energy and to spirit, linear rationalism, relationalism*

1. INTRODUCTION

EINSTEIN established a relation of equivalence between matter and energy [1]. An equivalence relation is composed of three distinct and separate terms. To the knowledge of this writer, so far there is no identified third term to which both matter and energy are equivalent. Hence the relationship is not formally valid yet. This paper proposes that the third term of the equivalence be posited to be spirit.

After observing some of the canonical requirements of the equivalence relation and the fundamental advantages of casting our thought processes into this format for the force it brings to our reasoning, we shall first note the shortcomings of some potential solutions to the lack of formal validity of the equivalence of matter to energy and then we shall try to obtain an operational definition for the word spirit. Only then shall we observe some of the consequences of accepting the proposal of making spirit the third term of the equivalence.

If the proposal stands to all the tests of validity, this solution will eventually yield two considerable benefits. It will transform physics from a linear into a relational discipline. It will also tend toward the reunification of the physical with the social

sciences.

2. PROBLEM STATEMENT

Matter and energy are two terms. $E = mc^2$ is not an equivalence relation; c^2 is not a third term: c^2 is a unit of measure (of speed). As logicians know, to be valid, an equivalence relation must be composed of three terms. The three terms have to be reflexive (namely identical to themselves throughout the discourse), symmetric (one observes the same entity from two points of view in order to obtain a deeper understanding of both entities), and transitive (a third term must exist to which both terms are equivalent in order to eschew the confines of circular reasoning and to complete the analysis). With the assistance of the equivalence relation the analysis does not start from an arbitrary point nor does it end at an arbitrary point, but is rigorously interlocked.

These observations can be made more evident by specifying the progress of our thought processes and by casting them into a set of figures. Science eschews all singularities. There is a good reason for this practice. A single point, a single observation does not lead to an objective, replicable analysis or experiment. Analysis begins with the observation of two events. Yet, the observation of two events necessarily leads to circularity of reasoning.

Once we are faced with only two observations, we are obliged to observe all possibilities. Hence the mind is led back to the exploration of all potential outcomes of the position of Point B on the circumference of the circle in relation to Point A at the center of the circle. This is a process that eventually leads to a reversal of one's position and then to a return to the original position—and no certainty is necessarily acquired in the process. Therefore, science asks for a third term. The third term points the research in the right direction. However, if the third term is placed in a linear position, the end result might be a dispersal of the thought process into the empty infinity of an enlarged circle. Linearity leads to *progressio ad infinitum*.

It is the equivalence relation that restrains the analysis from collapsing into infinity by constraining the terms into an interlocked relationship as in its standard configuration: $A \leftrightarrow B \leftrightarrow C$. The equivalence relation starts in logic and has the widest possible range of applications. All forms of syllogism are based on

the equivalence relation. Hence the relation of equivalence is well known to the literati. The equivalence relation is also part and parcel of all mathematics textbooks. It stands at the very foundation of mathematics, in which three fingers of my hand (3 of base 10 number system) are equivalent to the word/number/symbol (three, 3, or III) and to the three apples in front of my eyes. A triangle is based on the equivalence relation. The whole of trigonometry is based on the equivalence relation. Indeed, as R. G. D. Allen pointed out, the rules of equivalence “hold” also for the relation of “equality (=)” [2].

In brief, there are many reasons why it is essential to cast any scientific analysis in the format proposed by the rules of logic in general, and the principle of equivalence in particular. A few of them, not necessarily in their order of importance, are as follows. Logic, as a whole, provides objective criteria for the evaluation of any proposition; most disagreement, as is well known, disappears as soon as the magic words are pronounced: “But that is not logically tenable.” Logic provides guidance to our analysis; without it, we are rudderless. Guided by rules of logic, we know whether or not we have completed our analysis. Logic makes it possible to replicate the reasoning or the experiment.

From the above it inexorably follows that the fundamental relationship that Einstein established between matter and energy is yet incomplete. Two terms do not make an equivalence relation. The relationship between matter and energy is completed only when a third element is found to which both matter and energy are equivalent.

3. INADEQUACY OF SOME POSSIBLE SOLUTIONS

There are no explicit formulations of a third term to which both matter and energy are equivalent. As pointed out above, c^2 is not a third term, but a unit of measurement of speed that has nearly nothing to do with light. It happens to be the speed of light; hence, at best, it is an attribute of light. By extension, it might be assumed that mc^2 contains in it, not just the meaning of matter, but also—implicitly—the meaning of light. Even if c^2 stood for light, it cannot be the third term because light is a form of energy (clearly in the wave conception of light; or a form of matter in the particle conception of light). Thus, whether light is an intrinsic component of E or m , it cannot at the same time be an extrinsic term to which either E or mc^2 might be equivalent. It cannot appear as an addition to either side of the equation, without creating double counting and without violating the first requirement that each term of the equivalence must be reflexive, namely identical to itself throughout the observation. The addition of the term light does not make the construction symmetric; one cannot change the term light with the term energy (or matter) and obtain positive

results: one does not gain a better understanding of either matter or energy. Neither does that addition make the terms of the construction transitive: from light one necessarily goes back to either matter or energy—not to both. These considerations can also be put in common language: a part cannot be confused with the whole. If light is part of energy or part of matter, light cannot be equivalent either to energy or to matter, because this definition would run into the impossibility of equating a part with the whole. Since matter and energy, to be equivalent to each other, must be whole units, namely units or entities all complete in themselves, the third term must also be a whole unit, a whole entity. It cannot be a part of a whole.

The same considerations apply if the term third is assumed to be derived from the equation $E = hv$, where E is energy, h is Planck's constant (which is equal 1 and thus disappears from the equations of physics), and v is the measure of the frequency of energy radiation emitted as photons, rather than the speed of light.

A more abstract set of considerations are necessary to dispel the notion that space (like the old ether and the futuristic “higher order”) might be the third element of the equivalence. The third element has to have an existence of its own. Take away matter and/or energy and space disappears from our field of observation. Hence it cannot be the third element that would make the equivalence of matter to energy a valid relationship.

We must search for a third term to which both matter and energy are equivalent.

4. FINDINGS

This paper proposes that the search for the third term to complete the equivalence of matter to energy is exhausted with the introduction of spirit into the relationship. This is the answer that Fritjof Capra [3] inspired. One then obtains the following equivalence: matter \leftrightarrow spirit \leftrightarrow energy. This is a relationship that reads: matter is equivalent to spirit and spirit is equivalent to energy. This is a complete relationship of equivalence, which can be defined as the Relational Reality, and it can be diagrammed using these established protocols:

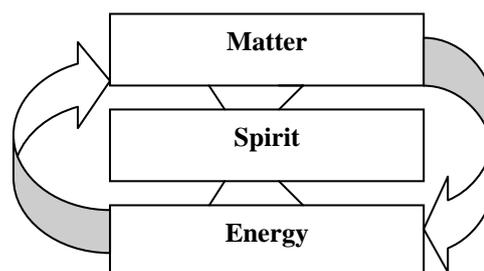


Figure 1: The Relational Reality

Figure 1 can be interpreted not only to mean that matter transforms itself into energy and

energy into matter, but—at the very least—especially along these lines: The physical world in which we live has to be observed first from the point of view of matter and then from the point of view of energy. The essential prerequisite is to see these two aspects of reality not in linear fashion, but in a relational mode, namely as two separate and distinct viewpoints of the same reality. When that is done, one can also see that the total reality in which our daily existence is immersed can be grasped only if it is observed, not only from the viewpoint of matter and energy, but also from the viewpoint of spirit. One enters into the stone with a hammer; into the energy of the stone with a cyclotron; and into its spirit with prayer.

Thus we come back to the very roots of our civilization. Our ancestral ancestors—not unlike many brothers and sisters in many civilizations of today—started their analysis of the world neither from matter nor, certainly, from energy. It is fairly certain that they started their analysis of the world from the point of view of spirit.

But what is spirit? Can we obtain a precise definition of this term? Can we obtain an operational definition of this term?

5. ON THE DEFINITION OF SPIRIT

Spirit is incommensurable. Therefore, it is difficult to define. Once it is realized, as we shall more clearly see below, that mathematics, the most precise of all sciences proceeds on the basis of two incommensurable entities, namely zero and infinity, this inherent difficulty that is presented by the word spirit ought not to be of much concern to a physicist. That said, we shall try to identify some of the characteristics of spirit. As used in this paper, spirit is a relation, the relation that binds matter to energy. It keeps them both factually together and intellectually separate from each other. With the word spirit, we can stop thinking of the universe as a linear relationship in which matter somehow passes into energy, and we can start conceiving of the universe of matter being in organic relationship with the world of energy. We can study the objective reality first as a world of matter and then as a world of energy. These are all enclosed worlds of their own. If we conceive of both matter and energy as two entities, indeed as two worlds, in their own, without their individual link to spirit, they would both be in fatal conflict with each other. Instead, we notice near perfect and continuous harmony between the two entities. This we might say is an attempted definition of spirit in the small, as in “the spirit of this stone”: spirit is the link, the glue that holds matter and energy together.

By trying to define spirit in the large, as an infinite entity into which both matter and energy are encompassed, and indeed as an infinite entity in which we—observers—are all encompassed, we might gain a greater control

over the forces of this world by regaining the sense of what used to be called the “sacred”. Only if the earth is seen as sacred again will we feel obliged to respect its inner existence. It is through the word spirit that we reach a better understanding of both matter and energy. Through that word, we enter deeply into their essence and we get in close contact with each of them. In an age in which we are discovering the essential importance of a sound ecological management of the planets, the word spirit will incite us to gain a greater respect for the world of matter as well as the world of energy than we have at present.

Thus the word spirit has a theoretical as well as an operational validity. And then it can inexorably be observed that the infinity of spirit manifests itself to us most clearly as both matter and energy. Hence, the preeminence of the study of physics in today’s culture is no longer surprising.

6. AN EXTENSION OF THE WORD SPIRIT

But spirit does not manifest itself only as matter and energy. It also manifests itself, indeed, as spirit. Man’s mind has forever been engaged in the attempt to define “spirit”. We must admit that the task has eluded us. And there is a very good reason why the task is destined to elude us forever. Spirit is not an intellectual affair, hence it can never be caught by the intellect. Since it is an intensely personal relation, indeed an intensely personal affair, the essence of the word spirit can only be caught by our feelings. This is the fundamental reason why approximation to the understanding and explanation of spirit have been in the past the prerogative of mystics, theologians, philosophers, literati, and musicians. As the practitioners of these disciplines have forever made an attempt to convey their understanding of spirit to all other people who may be interested in the topic, so physicists in the future—as they have indeed done in the past (see, e.g., Aristotle and Thomas Aquinas)—have to try to convey to the practitioners of the spirit the goodness, the truth, and the beauty that they discover in both matter and energy.

7. SOME LIMITATIONS OF THE MEANING OF SPIRIT

One could define spirit as Spirit, namely as God. However, this definition might be misleading; it might lead into the old pitfalls of pantheism. To avoid such dangers, it is necessary to distinguish God from God’s spirit; it might be necessary to say that God is also spirit; and then one must be careful to limit God’s presence in matter and energy by saying that the spirit of God is also in matter and energy, also in the stone and its energy. If God is by definition everywhere, then—given the above qualifications—it is possible to say that God is also in the stone and in its energy. And then one

surprising result ensues: a very practical consequence indeed. It appears that all three entities of thought, namely matter, energy, and spirit might share the same unit of measure: degrees of heat. One of God's characteristics is to be in essence love, Love par excellence. And is not warmth and heat one of the most endearing physical manifestations of love?

8. SOME IMPLICATIONS FOR PHYSICS

Not being a physicist, this writer can suggest some of the implications for physics of establishing a true equivalence between matter, energy, and spirit only at a very broad level of generality. When one multiplies the mass by the square of the speed of light, when one spins matter at the squared speed of light, one no longer observes matter but energy. One is no longer in the world of matter, but in the world of energy. One has made such a definite break between the two worlds that, in order to achieve clarity of mind and expression, one must accordingly design a new nomenclature. Using words from one world and applying them to the other leads to analogical thought, but not to innovative and incisive thought.

The second consequence that this writer can envisage is the need to jettison the old attachment to absolute quantification. Quantification in physics has always taken place within sharply defined limits. One has simply to resign to the nature of things that this is the only type of quantification that might forever be viable in physics. In order to reduce the level of apprehension about this condition, physicists will want to notice that mathematics too has always been subjected to this condition. If one does not see the number system as a linear but a relational organization of numbers, it becomes clear that mathematics is based on the following foundational equivalence: $0 \leftrightarrow 1 \leftrightarrow \infty$. The first impression is that mathematics has been able always to proceed with the quantification of only one of its terms: namely, the number 1. Mathematics does not, and cannot quantify either zero or infinity. And it does not matter. Indeed, on second thought, mathematics does not quantify the third of its foundational terms either; mathematics does not present us with an absolute quantification of one, but a relative quantification of one. Numbers proceed from (plus or minus) one to infinity, but they never touch infinity; the conception of the limit is there to recognize this deficiency and to allow us to work within the limits offered by reality. Thus, taking a leaf from the transition from Galileo and Newton to Einstein through Hume in relation to space and time [4], we shall not be concerned with absolute but with relative quantification.

Hence, we can safely maintain that

If the universe is infinite, we shall never weigh its mass;

If the universe is infinite, we shall never

measure its length;

What we measure is its mass and its length in relation to man.

Then, man—indeed, every man and woman—is again positioned at the center of the universe.

9. SOME CONCEPTUAL CONSEQUENCES

In 1946 Einstein remarked: "The unleashed power of the atom has changed everything save our modes of thinking" [5]. With the establishment of the equivalence of matter to spirit and to energy, everything changes. Technically, Figure 1 establishes that while any element of reality occupies its own distinctive position, everything is in full relationship with everything else. Hence, as proved by the Internet, everything is indeed directly related to everything else. This complexity is better observed by rotating at ever increasing speed, not only the entire Figure 1, but also each rectangle inside Figure 1 about its geometric center. One then obtains the image of four circles: one, the circle of matter; two, the circle of spirit; three, the circle of energy; four, the circle of the relational reality as a whole. This is a Venn diagram delimited by a circle. And what is a circle, if not a two-dimensional image of a sphere? Ultimately, one is thus presented with a construction composed of four interpenetrating concentric spheres, one for each point of view from which reality can be observed: the point of view of matter, spirit, energy, and the system as a whole. An analysis of this type of construction can be followed in detail in the humbler reality of the world of economic justice [6] and the world of economics [7]. The mathematics of this construction is well-known [8] and it might be useful to reproduce it here in a very abstract form as follows:

$$\begin{aligned} a' &= fa(a,b,c) \\ b' &= fb(a,b,c) \\ c' &= fc(a,b,c), \end{aligned}$$

where a' = rate of change in the first element of the relationship, b' = rate of change in the second element of the relationship, and c' = rate of change in the third element of the relationship.

From the linear world of rationalism, thus everything is transformed into the organic world of relationalism. Above all, beyond changes of perspective in physics, if this construction of reality is accepted, the warlike relation between the "two cultures" is expected to change and eventually to come to a screeching halt; with time, this war—with its multifarious manifestations of reductionism, materialism, and atheism, and, above all, mutual misunderstandings—will unavoidably come to a screeching halt.

While waiting for a response to these observations from the people of science, we already know the response from the people of spirit. Poetry and philosophy have spoken

forcefully about the evident relationship between matters of the earth and matters of the spirit [9]. Since this writer is more familiar with the Catholic tradition, he will limit himself to one quotation from within this belief system. But many other expressions come easily to mind. "Every culture," Christopher Dawson wrote, "is like a plant. It must have its roots in the earth, and for sunlight it needs to be open to the spiritual. At the present moment we are busy cutting its roots and shutting out all light from above" [10].

If mathematicians and physicists, following strict rules of logic that they already obey in all steps of their reasoning, can be convinced that their own fields—as moral theologians insist—are all immersed into the world of spirit, all other scientists, especially social scientists, will not take long to follow suit. After all, it was Einstein who said: "Science without religion is lame, religion without science is blind" [11].

10. CONCLUSION

There are many indications that the world of linear, rational, Cartesian logic has come to an end—see, e.g., John Lukacs, *At the End of an Age* [12]. This is a world in which reality is reduced to isolated atoms. The principle of equivalence is a ready-made tool that allows us to escape the strictures of Cartesian logic and leads us into the world of relational logic, a world in which everything is naturally related to everything else. This paper has used this principle and reached some novel conclusions in relation to physics and mathematics. In the process, it has laid the groundwork for healing the ongoing schism between the "two cultures".

A POSTSCRIPT

The reader might be interested to know that this paper was not written with the Shroud of Turin in mind. Yet, at one point it became apparent to this writer that the paper makes the Shroud a logical and "natural" necessity. Even the Transfiguration and the appearance of Jesus in the Cenacle become understandable, because—if this reasoning is right—Jesus is, was, and will forever be the perfect union of matter and energy and spirit. And, of course, accepting this reasoning one can see that the consecrated communion host is real.

If this reasoning is accepted to be theologically and logically valid, it leads to a further observation. The study of singularities is not concluded by the study of matter alone, or energy alone, or spirit alone. It is the integration of the three worlds that might yield a better understanding of singularities as well as a better understanding of the world as a whole.

The study of singularities cannot be eschewed by science. Science cannot thus limit itself. Indeed, as various technical studies of the Shroud of Turin prove, science has an essential

role to play in the analysis and the distinction of true from false singularities.

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