THE UNITY OF PHENOMENA ON DIFFERENT SCALES AS EXEMPLIFIED BY THE RESEARCH OF ALBERT EINSTEIN AND PAUL DIRAC:

THE RELEVANCE OF A NEW UNIVERSAL CONSTANT

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ABSTRACT: Reviewing the older, different approaches in physics may enable one to integrate them. This may provide new insights into physical existence. The theoretical approaches of Albert Einstein and Paul Dirac, during the earlier part of the twentieth century, indicate remarkable similarities, even though their approaches respectively addressed different levels of existence, with seemingly different structures. Because of such similarity or unity, both theories or approaches predicted the positively charged electron. Having the same predictions experimentally confirmed in 1932, validating the two theories, both theories would have been common avenues to revealing a deeper feature of reality, universally present and marked by a new universal constant. It is unknown as to why both men did not see this and subsequently collaborate on elaborating such a unification and its implications. A new generation of physicists and philosophers, with new perspectives, may be able to do so.

KEYWORDS: Approaches; Dirac; Einstein; Electron; New paradigm; Predictions; Theoretical; Unity; Universal constant

1. THE INTEGRATION OF TWO THEORETICAL APPROACHES

In order for the physical and biological sciences to advance conceptually, it might be worthwhile to review older, different scientific theories or presentations and to determine whether it would be productive to integrate them from a new perspective. Integrating the earlier theoretical work of Albert Einstein with that of Paul Dirac might very well result in new insights into the nature of reality. In this regard and to see if this would be a productive approach or exercise, let us

briefly examine theories developed by Einstein and Dirac, which were first presented in the 1920s and early 1930s, and see if such integration would be possible and insightful. One begins with a consideration of Einstein's work in the 1920s on a unified theory pertaining to the electron.

2. EINSTEIN'S APPROACH

Albert Einstein investigated a unified field theory, where a symmetrical gravitational force field and an asymmetrical electromagnetic force field are united. He, using only general relativistic methods, showed, as a consequence of such unification, that a mirror configuration, in the form of an asymmetrical electromagnetic field, can arise due to relativistic dynamics or principles. This is because, as deduced from the theory, there is an invariance with regard to space-time mirroring: "for every possible field corresponding to an elementary particle for positive charge, there also exists a [mirror]field describing an elementary particle with negative charge but with identical rest mass," as Einstein's theory or approach is described by Folsing in 1997 [1].

Regarding electrons, a mirror-form of an electron and its asymmetrical field would have the same mass-energy of the other electron with its negative charge and corresponding asymmetrical field, but would have a positive charge . This would be so by virtue of its mirroring the form-configuration of the asymmetrical field structure of the negatively charged electron. This led Einstein to conclude that mirrored, concentrated field-configurations or entities having the same mass-energy of an electron with its field, but with a positive charge, should exist [1]. Significantly, Einstein's unified field theory, applied to electrons, implicitly predicted the existence of positively charged electrons [1].

However, at that time in 1925, no known entity/structure as a positively charged electron existed., and physicists at the time would only consider the existence of the two known particles [1]. These were the negatively charged electron and the positively charged proton, which is of far greater mass than the electron and thus would not be the mirror entity/configuration of the electron. They were not open to the possible existence of other charged particles. Because such a positively electron did not exist, contrary to what his unified theory determined would be the situation, and not concluding or predicting a possible future discovery of such, Einstein eventually disregarded this theoretical approach to the unification of the different fields in 1925 [1].

Nevertheless, his published, theoretical approach in 1925 implicitly predicted the existence of the positively charged electron, and six years later such an electron was discovered. This demonstrated that a new unified field theory exercised on the macro-level predicted the existence of a new structure on the micro-level or quantum level. Its subsequent discovery would have given experimental validation to Einstein's unified field theory.

3. DIRAC'S APPROACH

Paul Dirac's theoretical approach pertaining to the electron is described in various publications, for example [2]. Independently of Einstein's approach, he, as a quantum physicist, combining quantum mechanics with special relativity, and using a geometrically oriented mathematics, predicted the existence of the positively charged electron in 1930, later referred to as the positron. Using the methods of special relativity, he concluded that electrons can also have a negative energy state. He saw that such electrons with negative energy exist in a vast continuum or sea. When such an electron left that continuum, it left a hole. The hole represented the opposite energy state of the departed electron, that is positive energy. Also, the hole being the opposite of the charge of the departed negatively charged electron represented a positive charge. In effect, the hole represented a electron of positive charge and energy. Though not stated by Dirac, the hole might also have represented a complementary-mirror structure-form of the electron, a structure-form with positive charge and energy.

4. TWO THEORETICAL APPROACHES CONVERGE ON THE SAME DISCOVERY

Thereby, a deeper, intrinsic geometry may also have united Einstein's and Dirac's greatly different, imaginative theoretical approaches or theories Because Dirac explicitly predicted the existence of the positively charged electron, he is credited for making the prediction that anti-particles exist, that is, anti-matter. Unlike Einstein, Dirac foresaw, based on his theory or approach and conviction, their discovery.

However, the two different theoretical approaches, one based on proposed, mirrored asymmetrical fields operating on the classical, space-time level and another based on a quantum mechanical model operating on the micro-level,

using different quantum energy states, and the conclusion of a negative energy state for the electron, led nevertheless to the same prediction and later discovery through experiment. In effect, a macro-level approach and a micro-level approach respectively involving different theoretical scales led to the same prediction. This clearly indicates that there is an intrinsic unity or connection between the theoretical model on the macro-level and the theoretical model on micro-level or quantum level, thus a likely unity between the fields operating on these respective levels. And as noted, one feature of this unity might be geometries of complementary or mirror configurations. Though in applying Special Relativity, Dirac's approach in effect incorporated in part a macro-approach.

5. THE POSSIBILITY OF A NEW UNIFIED FIELD THEORY INVOLVING A TRANS-DIMENSIONAL CONSTANT? A UNITY OF SCIENTIFIC APPROACHES MIRRORS A UNITY IN NATURE

Because of this unity, predictably, the same underlying constant should apply to both levels of reality. And as illustrated [3, 4], the dimensionless (or trans-dimensional) biological constant Φ (or 1.618) could be that constant, and it could represent the operational unity of both realms. As pointed out [3, 4], Φ is the dimensionless component of the electric charge constant. Interestingly, Φ^{-1} is the mirror image or operation of Φ. Where Φ might represent the generation of an electron-field structure or form defining a negative charge, Φ^{-1} might represent the mirrored generation, perhaps vortical, of an electron-field structure or form defining a positive charge. These constants might also suggest the underlying unity of different, complementary scientific approaches or theories. In this regard, entirely different scientific approaches, based on different assumptions or theories, can nevertheless lead to the same experimentally confirmed predictions. This implies that different approaches have an underlying unity due to an underlying unity in reality, irrespective of scale. This would also imply that a biological approach to physics could also reveal a deep unity within existence.

It is not clear why Einstein did not reconsider the validity of his 1925 unified field theory regarding the electron after the discovery of the positron. Surely, it must have indicated the validation of his approach and theory, especially as it implied a unity, through levels of reality, of a unified-field structure with a quantum mechanical reality. Could he not have collaborated with Dirac on this

when Einstein had an opportunity to do so?

As described by Farmelo in 2009 [5], Dirac had great respect for Einstein and his General Theory of Relativity. During the late 1930s, both men were at the Institute for Advanced Studies in Princeton, Dirac being on sabbatical leave from Cambridge at the time. However, both men never collaborated, according to Farmelo [5]. In view of the similar outcomes of their different though very important approaches, this remains a mystery in the history of science, a failure to seize an opportunity of great import. Had they done so, maybe a wondrous, paradigm-breaking unified field theory for physics and biology would have been created, perhaps emphasizing the critical operation, across all scales of reality, of a unifying dimensionless or trans-dimensional biological constant and its forms. Hopefully, a new generation of scientists and philosophers could take up this challenge with courage in an endeavor that could result in a new paradigm integrating physics and biology, ensuing in major social and economic benefits.

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