

## Preface

Theoretical physics is presently at a very exciting time in the history of scientific discovery. For we are at a precipice facing two conflicting 20th century revolutionary movements in physics, each purporting to be basic truths of nature – the quantum theory and the theory of relativity.

In the 20th century the mathematical expression of the quantum theory yielded correct predictions of a great deal of the data on the behavior of the molecular, atomic, nuclear and elementary particle domains of matter. In the same period, the theory of relativity successfully described new features of material systems. In special relativity, the relativistic Doppler effects (transverse and longitudinal) of electromagnetic radiation, and the mechanics of matter that moves at speeds close to the speed of light, revealing, for example, the energy mass relation,  $E = mc^2$ , revolutionized our thinking. In its form of general relativity, it has yielded a formalism that successfully predicted features of the phenomenon of gravity, also predicted by the classical Newtonian theory, but in addition, features not predicted by the classical theory, thereby superceding Newton's theory of universal gravitation.

The problem we are now faced with, in these early decades of the 21st century, is that in their precise mathematical forms and their conceptual bases, the theory of relativity and the quantum theory are both logically and mathematically incompatible. They each entail opposing paradigms on the true nature of matter and radiation, as well as opposing epistemologies. For the purpose of description of particular phenomena, and so long as the physical conditions that require the use of the quantum theory and the theory of relativity do not overlap, these theories may be expressed separately. But in general, for the purpose of explanation, we must consider the conditions where both theories would be required simultaneously to correctly represent the laws of nature.

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Examples of such attempts are high energy particle physics, called relativistic quantum field theory, and the theory of general relativity, to represent the gravitational manifestations of matter.

Further, even in those cases where the empirical conditions for each of these theories do not overlap, as an explanation of the behavior of matter we cannot accept both simultaneously, if they are in principle both logically and mathematically incompatible. This would yield a logically inconsistent understanding of the nature of matter. Thus we are at a precarious precipice where we must choose one of these theories or the other, but not both, lest we fall into the mire of conceptual inconsistencies, below the edge of the cliff!

My research program, as it has developed over the past 40 years in the literature, started with the attempt to answer the following question: is it possible that the formal structure of quantum mechanics is not more than a linear approximation for a theory of matter that is based on the foundations of Einstein's theory of general relativity, as a general theory of matter? For if this were the case it would signify a genuine paradigm change in physics, from linearity, indeterminism and the fundamental role of probability and measurement, to views of holism, continuity, nonlinearity and determinism, where measurement and probability play no fundamental role. It would be a change from an atomistic model based on the epistemology of logical positivism, to a holistic view of the universe, based on the epistemology of realism. In the latter holistic ontology, the 'things' that we identify, for example, with electron, proton, DNA molecule, people, planets, galaxies, etc., are not separable, singular entities; rather, each is of the infinite distribution of real, distinguishable manifestations of the single continuous universe – of its correlated, though inseparable modes.

The basic attempt, then, in this book, is to initiate a study of a single, coherent theory of matter applicable to all domains – from elementary particle physics to cosmology. The approach taken is that of a fully exploited theory of general relativity, from its mathematical and conceptual bases.

The reader should not assume that the claim is made of full accomplishment of this goal, nor that such a total theory could ever be accomplished. It is, rather, that it is the belief of the author that the attitude toward such a coherent theory should be conducive toward real progress in our understanding of physics in all domains.

I am most grateful to my loving wife, Yetty, for her encouragement and her indispensable role as a 'sounding board' for ideas, during the

entire development of the research that led to the final fruition of this presentation.

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