Introduction

Physical reality is governed by principles; these principles and their consequent laws can, stage by stage, be perceived by humans. This idea is the starting point of physics, which, based on the available experimental information at each stage, hypothesizes the existence and the essence of these principles in an attempt to describe them and their consequent laws correctly. A postulate provides a description of one of the above governing principles; the nature of a true postulate is that it remains unaltered throughout the evolution of physics. A misleading postulate, on the contrary, is not a part of the complete physics, and is abandoned during the evolution of physics. The laws of physics are derived from its postulates. These laws are customarily believed to be equations, but they might also be combinations of programs and equations. The laws of physics are based on the set of postulates known at the time of their formulation; the nature of the laws of physics is that they might be modified when the set of known postulates evolves. The laws of physics consist of an essential part and a quantitative part. The essential part of a law is the nature of its mathematical relations. Its quantitative part is its fundamental parameter(s). The quantitative description of physical reality requires the introduction of physical quantities, and the definition of the units of these physical quantities. The quantitative description of any domain of physical reality should satisfy the laws of physics which are applicable in that domain.

Physics develops in stages. A more advanced stage differs from its previous stage/s in that it better satisfies the requirement for the simplest possible and most consistent description of the principles of nature, and in that it is applicable to an extended domain of physical reality. The transition from a less advanced stage to a more advanced stage is required when the less advanced stage does not explain consistently the available observations. *The transition is ultimately done by discovering principles of Nature which previously were unknown*. This necessarily involves exposure and abandonment of tacit or explicit misleading assumption/s. These misleading assumptions seem to be self-evident truths so that they are

presupposed without sufficient consideration. Also, in spite of being essentially false, they are useful or at least harmless in some partial domain of physical reality. Due to their essentially erroneous nature, however, and especially when they are applied outside of this partial domain, they generate inconsistent results. As long as the falseness of the relevant assumption/s is not recognized, these inconsistent results are usually regarded only as apparent discrepancies, which are "resolved" by introduction of superfluous "physical realities", and/or by making some incorrect adjustment/s to the current theory.

The misleading assumption that Earth is stationary is central in Ancient Physics. The misleading assumptions that simultaneity[1] is absolute and that particles and waves are two distinct things are central in Classical Physics. In each of these cases, the abandonment of the misleading assumption led to a groundbreaking development. It made it possible to discover unknown postulates, unknown physical quantities, and unknown fundamental parameters that led to the development of more advanced schemes: Newtonian Mechanics, Einstein's theory of Relativity, and Quantum Mechanics.

The desire for better understanding of physical reality and of its governing principles requires a discerning eye and a radical non-tolerating approach towards discrepancies, an approach that may lead to the exposure of the false assumption/s responsible for these discrepancies. Due to powerful non-scientific reasons (see the quotation from Tolstoy in the opening of the book) this fruitful radical approach is only rarely applied. It has always been more common to search in vain for adjustments that will make the discrepancies "disappear" without examining any of the tacit or explicit fundamental assumptions of the existing theory. These adjustments are usually some invisible fictitious *ad hoc* "physical realities" which locally "solve" difficulties, but do not exist in the interrelated sense in which true physical reality exists. This was the approach of the Ptolemaic scholars who conducted careful astronomical observations and charted models of complicated celestial spheres which

[1] Simultaneous events have the same time-coordinate.

were believed to carry the heavenly bodies around Earth in a futile attempt to adhere to the misleading assumption that Earth is stationary. Insightful James Clark Maxwell introduced the invisible *luminiferous* ether in a futile attempt to reconcile the conflict between his correct laws of electrodynamics and the "self evident truth" of absolute simultaneity. And H. A. Lorentz hypothesized the contraction of moving bodies in order to reconcile the result of the Michelson-Morley experiment with the undoubted existence of this invisible "physical reality". Typical of *ad hoc* fictions is that they apparently "solve" a specific difficulty but are useless any where else. On the other hand, solving a specific difficulty by realizing the relevant missing postulate(s) helps to solve also difficulties that are apparently not related at all, and yields predictions that are also apparently not related at all.

Are there any misleading assumptions, similar in essence to the assumptions responsible for the geocentric cosmological model and for the belief in the existence of the ether, in the set of the fundamental suppositions of Modern Physics? Rich and significant observations have been added to the known database *after* Modern Physics was postulated; does Modern Physics "explain" part of them by superfluous "physical realities"? Although it is psychologically hard to accept for people educated in the twentieth century, the answer to these two questions is definitely affirmative, and in it lies the key for the development of the next stage of physics. Modern Physics offers insightful solutions to difficulties which Classical Physics encounters. However, it is not free of difficulties and discrepancies, especially where large-scale cosmology and particle physics are concerned. When the discrepancies in Modern Physics are examined carefully without *a priori* convictions and in the rare state of adequate knowledge combined with independence from contemporary scientific authorities, nine misleading fundamental assumptions and three principal superfluous "physical realities" can be identified. The aim of this book is to expose these misleading assumptions and these non-existing "physical realities", and to introduce the key features of the next stage of physics which emerges when they are abandoned.