J.R. Croca and J.E.F. Araújo (eds.), *A New Vision on Physis. Eurhythmy, Emergence and Nonlnearity*, Lisaboa: Center for Philosophy of Science University of Lisbon, 2010

Reviewed by Gerard Leonid Stan*

The study of ontology and of the theory of scientific knowledge has been radically changed by the massive theoretical accumulations in 20th century physics. Gradually, the pure speculation was replaced by a systematic, synthesising and integrative reflection on the most relevant results of physics and other natural sciences.

The volume *A New Vision on Physis. Eurhythmy, Emergence and Nonlnearity* published by the members of the Center for Philosophy of Science University of Lisabon is inscribed in the trajectory of a philosophy of nature seeking to integrate, unify and resignify knowledge offered by present-day physics. The authors see their endeavour as a *Manifesto* for a new way of looking at natural phenomena. The concepts they use and the formal apparatus they propose are seen as instruments capable of constructing an alternative to the traditional, Cartesian, linear method of looking at nature and its phenomena. The approach they advance is a global nonlinear picture of the natural world. They start from the idea that the natural phenomenon, considered as a whole, is altogether different from the sum of its parts; the emerging entities behave in a way that cannot be inferred from the properties of the component parts. The mathematical formulation of this new approach is consonant with the principle of Eurhythmy.

The first paper in the volume, J.R. Croca's *Hyperphysis, The Unification of Physics*, provides the philosophical, conceptual and general-formal framework for this new approach of natural phenomena. The framework he proposes does not aspire only to be conducive to a unification of physics, but also to a clearer and deeper understanding of physical reality. On the basis of the proposed nonlinear approach, guided by the principle of Eurhythmy, quantum and relativistic physics can have a unitary and causal description. The unity of the world should be reflected in unitary explanations and descriptions. According to J. R. Croca, this

* ACKNOWLEDGEMENT: This paper was made within *The Knowledge Based Society Project* supported by the Sectorial Operational Program Human Resources Development (SOP HRD), Financed by the European Social Fund and by the Romanian Government under the contract POSDRU/89/1.5/S/56815.

aspiration of physics towards unity can be traced to the principle of Eurhythmy and to several other fundamental assumptions, shared by all researchers taking part in this reconstructive effort. The principle of Eurhythmy comes from the Greek word *euritmia*, meaning "the adequate path, the good path, the good way, the right way, the golden path." (p. 5) This principle tells us something essential about the general tendency of complex entities of persisting in their existence.

According to J.R. Croca, the unification of physics can be accomplished if it is based on the following five assumptions: (1) The metaphysical principle of realism: "there is an objective Reality. This is observer-independent, yet, it is understood that the observer interacts with the very same reality being able to change it and of course of being changed in a greater or lesser degree." (2) The postulate of the existence of a subquantum medium: "there is a basic physical natural chaotic medium named the subquantum medium. All physical processes occur in this natural chaotic medium." (3) The postulate of the existence of physical entities: "what are called physical entities that is, the particles, fields and so on, are more or less stable local organizations of the basic chaotic subquantum medium." (4) The postulate of organisation: "in general the complex particles, stable organizations of the subquantum medium, are composed of an extended region, the so called theta wave, and inside it there is a kind of very small localized structure, the acron." (5) The principle of eurhythmy: "the acron inside the theta waves follows a stochastic path that in average leads it to the regions were the intensity of the theta wave field is greater." (p. 9) As J. R. Croca explains, the principle of Eurhythmy essentially postulates that "the acron possesses a kind of extended sensorium, its theta wave, with which it feels the surrounding medium." (p. 11)

Based on these principles, the author goes on to elaborate sets of equations capable of describing complex particles (the concept of complex quantum particle is extended from quantum physics to the entire physics), the stability of a particle, the movement of an acron, the speed of an acron in different fields of Theta waves, the movements of several acrons. Eventually, he deduces a fundamental equation of nonlinear evolutions. The *Conclusion* emphasises the fact that all these formal developments are only a preliminary version of ongoing research. The final purpose of this paper would be to describe adequately the complex interactions between nonlinear phenomena. This would require devising an entire language, *i.e.* a new branch of mathematics which would assume from the beginning the deep interdependence of physical systems.

The first paper of the volume, which also has a programatic role for the entire research project undertaken by the members of the Center for Philosophy

of Science University of Lisabon, is followed by a series of investigations consisting of computer simulations of the behaviour of a single particle ('acron') inside a Theta wave, as well as of the interactions between this type of particles (Mário Gatta), the description of elementary nonlinear mechanics for localised fields (Amaro Rica da Silva), the study of the symmetry generated by the solutions to Schrödinger's nonlinear equation (Amaro Rica da Silva), presenting a mathematical solution to a nonlinear equation for a particular idealised case (J.E.F. Araújo). João L. Cordovil's paper attempts to indicate a complete set of *a priori* principles of natural philosophy, more precisely, a set of propositions concerning the nature of physical objects. However, principles such as "All physical objects have the same nature," "All physical objects are quantum objects," "A physical object is a wavebody," or "All physical reality is subquantum medium" (pp. 250-254) are rather hard to accept as 'evident truths' of natural philosophy. There are enough arguments preventing us from considering any physical object as a quantum object. If we consider this equivalence as improper, we can explain neither its concrete structure, characteristic to the level of reality it belongs to, nor the laws governing it. A quantum understanding of nature as a whole gives us a picture of homogeneity, uniformity and unity. But the world we see is heterogeneous, organised on relatively autonomous levels, with phenomena that are essentially irreductible to quantum phenomena.

The papers in the final part of the volume present the crisis in the natural sciences, drawing attention to the evolutional processes seen as the result of a weak teleology (a consequence of the principle of Eurhythmy) (Rui Moreira), apply this principle to different sciences, trying to explain the increasing degree of order and complexity encountered in nature (Gildo Magalhães), discuss the concept of emergence and the origins of the nonlinear mode of understanding natural phenomena (G.C. Santos), present several theses meant to contribute towards a new natural philosophy (P. Alves) or offer a discussion of the concept of time seen as one of the fundamental concepts necessary for the understanding of physical reality (J.R. Croca and M.M. Silva).

Stephen Hawking confessed that when he published *A Brief History of Time. From the Big Bang to the Black Holes*, somebody told him that every equation he included in the book would scare off half of its potential readers. He didn't neglect this piece of advice and included only Einstein's famous equation $E=mc^2$. Taking into account the number of equations in *A New Vision on Physis*, and assuming the advice Stephen Hawking received was correct, the readers of this volume cannot be very numerous. Those who will really benefit from reading this book are the physicists interested in the philosophical signification their

theories hold and in the idea of a unitary vision which could be found beyond the diversity of natural phenomena and theories of physics. Most of the potential readers with a philosophical background might have real difficulties in following the mathematical framework proposed for the description of natural phenomena. On the other hand, they would seriously doubt the real philosophical value of these mathematical developments. Also, philosophers would have been much more interested in more explicit arguments in favour of the unity of the physical world, of ontological reductionism (which is considered as self-evident by the authors), of epistemological reductionism or arguments for the possibility of devising a mathematical language which could provide a unitary description of natural phenomena. Moreover, we believe the reasons for which the authors formulated and included the principle of Eurhythmy should have been more thoroughly explained and also that it would have been necessary to evince the real problems solved through this principle and to emphasise more on the reasons for their belief in its productivity on a philosophical level.

As Pedro Alvarez warned in his paper (p. 369), before propounding a physical reconstruction of reality, we should analyse our powers to provide authentic knowledge of the physical world. In the absence of this preliminary critical analysis on the power of the sciences to provide knowledge, on the epistemic limitations of certain theories (like the quantum theory), we always risk replacing one set of classical dogmas with a new set of dogmas, an outdated perspective of the 'divine eye' with an updated one.