Dynamic Universe – natural science and philosophy in unison

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Abstract

In a coherent conception of reality, physics and metaphysics should both come together to create a comprehensible worldview. This was the case in the Newtonian picture of reality which contemporary physics proved limited at the beginning of the 20th century. The quest for a new synthesis, a more reliable picture of reality incorporating current theories and observations, has not been fulfilled in spite of a hundred years of interpretive discussions. The claim of this paper is that the missed unison can be found in Tuomo Suntola's Dynamic Universe (DU). This exceptional theory covers the domains of theory of relativity and quantum phenomena and fairly exceeds their level in philosophical virtues. DU is studied here from the perspective of natural philosophy concentrating on the basic principles of the theory, and the prominent metaphysical features that in addition to the mathematical structure can be found in a proper physical theory. Relying on the zero-energy principle, DU opens up a new kind of holistic framework for a reality where the Newtonian ideas of mass, space and separated objects are left behind. When turning the Newtonian clockwork into a pendulating, spherically closed 4D-sphere, DU discloses a seamless connection between mass, space, motion, and energy. All the seemingly separated objects turn out to be internally interrelated. State of motion does not affect time or spatial coordinates, and all the bodies can ultimately be constructed out of waves. In addition to its importance for physics, the framework provides justified answers to many age-long disputes in natural philosophy starting from the basic substance of being, the origin of movement, and the possibility of empty space - the most basic questions pondered by giants like Democritos, Plato, Aristotle, Descartes, Leibniz, and Newton. Most importantly, there is room for human beings to participate in modifying the lawfull unfoldment of things.

Introduction

In the history of Western culture, natural philosophy bloomed in ancient Greece and at the turn of the modern era when modern natural science had its beginnings. Empirical science was then for several centuries believed to provide the most reliable 'window into reality', until the beginning of the 20th century, when the theories in physics extended into an abstract non-representational level that has remained intangible for general public. Once again there is a call for natural philosophy to make nature comprehensible.

A shared conception of the world is important for people to navigate among the phenomena they encounter in daily life. Every civilisation has had their cosmogonical myths containing information about the creation, fate, and constitution of the world. By making things understandable, such basic frames and categories endow security, belongingness to a bigger scheme of things. They inform people about their lot in the world, advise how to explain phenomena in a suitable way, and act in a sensible manner. It is difficult for individuals in any culture to question long-lasting presuppositions, which are taken as self-evident as long as affairs proceed smoothly in accordance with the assumed frame. Cultural paradigms, like scientific

theories, are apt to be recognized temporary constructions only when they increasingly fail to explain new facts.[1]

The particle-mechanistic world-view that was created during the 17th century was based on Newtonian physics. The mechanical conception of the world wielded its influence extensively both inside and outside the realm of physics for more than two hundred years. It provided a well-functioning perspective into nature, and a suitable methodology for a more detailed study. The principles of Newtonian thinking are still widely used, and believed to be true, even though Newton himself regarded simple mechanistic philosophy as inadequate to explain the active living phenomena of nature[2] In addition to a given mathematical structure, a proper physical framework contains a metaphysical basis, and interpretation that spells out the nature of things and relations the theory is dealing with. The uttermost metaphysical and methodological principles that were adopted along with the Newtonian physics were atomism, determinism, reductionism, and the detached observer. There was no reason to doubt or discard their truth until recent physics, especially quantum theory, proved them limited, and distorted the Newtonian picture of reality.[3]

In a confusing situation when a long-held efficacious world view has outgrown its limits, there is still an opportunity for a more satisfactory conception of reality. Ontological and epistemological evaluation belonging to the field of natural philosophy has once again turned out essential when interpreting the abstract theories of modern physics. Yet, the quest for a new synthesis, a more reliable picture of reality, has not been fulfilled in spite of a hundred years of discussion. Physical understanding related to the basic principles of reality is not likely to proceed before the theories of relativity and quantum physics are unified. The main theories utilized in physics should not be incompatible.

In a coherent conception of reality, physics and metaphysics should both come together to create a unified worldview. The claim of this paper is that this is what occurs in Tuomo Suntola's Dynamic Universe (DU)[4]. The extensive theory, based on zero-energy principle, is easily comprehensible, and on the second thought almost self-evident. In a fresh metaphysical context, the mathematical abundance typical for present theories can be reduced to take in more physics. The comprehensive theory naturally unites the domains of theory of relativity and quantum phenomena. It incorporates the structure and dynamics of the entire physical reality, and provides a substantial physical framework where natural laws are seen to generate an all-embracing entirety that organizes itself into a multilayered unbroken whole.

In addition to its importance for physics, DU settles several age-long disputes in natural philosophy. It straightens the current quandaries related to the nature of space, time, and the basic substance of being. It puts an end to the question of whether matter and space are atomic or infinitely divisible by tracking down the nature of mass and the cause of inertia. And finally, it provides a possibility to reconsile humans as mental beings to a one overall system that is ruled by 'universal laws of nature'. All these features contribute in a notable manner to the most basic questions in natural philosophy pondered by giants like Democritos, Plato, Aristotle, Descartes, Leibniz, and Newton.

The recipe for success in DU is a spherically closed space in 4 metric dimensions and the zero-energy principle which are both reliable and well-known principles in physics. When allowing a metric 4th dimension, the zero-energy hypothesis in DU discloses a seamless connection between mass, space,

[1] Kallio-Tamminen 2004, 154-159, Kuhn 1970.
[2] Dijksterhuis 1986, 463-464. Tarnas 1998, 269-271.
[3] Kallio-Tamminen 2004.
[4] Suntola 2018, 2019.

motion, and energy. It offers a picture of the universe as a pendulating whole that naturally evolves into all the phenomena and cascades of structures in space we observe, giving energetic conditions for everything that possibly might exist. In DU the particle-mechanistic world-view developed in the 17th century in accordance with the Newtonian physics turns into a genuine holism where all the separated objects are internally interrelated – an idea of a lawfull universe that forms a flexible process where nothing that ever exists is disconnected from the totality of this magnificent entirety.

In this paper Dynamic universe is studied from the perspective of natural philosophy. The historical context is suitable for evaluating the merits the theory provides for formulating a more satisfactory conception of reality. A conception that, among other advantages, presumably allows all the observations in modern physics that do not fit into the Newtonian frame, to be explained. The paper concentrates on DU's basic principles, aims to trace in a plain conceptual manner the prominent metaphysical features that are behind its mathematical structure. Throughout the paper is manifested the author's belief that the relevance of philosophy should be better appreciated when developing and evaluating physical theories. Both the meticuluous work done within the philosophy of science in assessing the nature and merits of various theories, and the foundational hypothesizing and inventive reformation that has been the task of natural philosophy throughout history. Co-operation between physicists and philosophers might increase the ability of humankind to acknowledge the amazing possibilities prevalent in nature for a sustainable future.

The concept of mass and inertia in the history of natural philosophy

At the beginning of the modern era in 1689, Isaac Newton published his monumental work *Philosophiae Naturalis Principia Mathematica*[5], which united Kepler's planetary laws and Galilei's research on motion. This was an achievement that could nowadays best be compared to "a theory of everything" that would unify theories of relativity and quantum mechanics. The work completed the paradigmatic change in the conception of reality that Copernicus had started when challenging the Ptolemaen earth-centred view of the universe. Newton took vague terms like 'force', 'motion', 'mass' and 'inertia', and gave them a precise expression in mathematical terms. To provide a proper basis for the mathematical description of the motions of material bodies, he also gave new meaning to the old terms of space and time, postulating them to be infinite and independent of matter. The world of matter began to be understood as an immense clockwork that was controlled by exact eternal laws.[6]

Newton's laws described in detail how separate bodies moved in empty space under the influence of gravitational force. Every piece of matter in the universe attracted every other body with force proportional to the square of the distance between them. Newton, however, was not able to give an answer to the nature of this force. The idea that gravitational attraction could operate across empty space was against the dominant (Cartesian) mechanical theory that required direct contact between interacting bodies. Among others, the philosopher Leibniz fiercely critisized Newton's gravitational theory for requiring "occult forces" which remained beyond both rational explanation and human cognition. Newton absolutely rejected the charge that gravity was an occult quality. For him, it was not a hypothesis, it was an empirically established fact whose cause would be revealed in due time.[7]

[5] Newton 1972.
[6] Burtt 1980, 32-33.
[7] Dijksterhuis 1986, 489.

Leibnitz himself related the inertia of bodies to their weight and Descartes related it to their size. Newton distinguished between weight and mass, because the latter did not vary with motion, and related inertia to a body's mass. Classical mechanics adopted Newtonian mass as a kind of constant, 'the quantity of matter in a body'. It was an 'intrinsic' property of a body which did not depend on the body's velocity. Newton's account of mass in his third law is, however, notoriously unsatisfactory. His definition of mass as the product of a body's density and volume is quite useless, since the density of a body is commonly defined in terms of its mass and volume.[8] Newton's laws of motion do not provide a literal definition of mass, and Ernst Mach was the first to propose the definition which has been widely adopted.[9] Mach equated the 'relative masses' of bodies with the 'negative inverse ratio of their mutually induced accelerations'. As has been repeatedly emphasised, the constancy of this ratio is not actually a matter of definition, and it is in the affirmation of this constancy that the main burden of the third axiom lies.[10] The origin of gravitation and inertia that affects all bodies remained a mystery in Newtonian physics and has not been decisively solved by the theory of relativity either. In the wider framework disclosed by DU, an explanation can finally be given.

Einstein in his achievement modified the notions of space and time, and disclosed an intimate relation between mass and energy. The theory of relativity however preserved the customary idea of separate bodies, which Galileo had adopted from ancient atomism.[11] Leucippus and Democritus assumed that physical bodies are formed out of tiny particles, and all real happenings in reality can be reduced to these particles moving in empty space. Natural science quite wholeheartedly adopted the mechanistic and reductionist conception of matter which became an essential part of the Newtonian world-view. The assumption that the whole can be reduced to its parts, and all natural events can, in principle, be genuinely analysed via these represented a new view of the mutual relationship between the whole and its constituents. While the alchemy and occultism of the Middle Ages were largely holistic, meristic methodology was generally regarded as a huge intellectual breakthrough in the historical development of science.[12]

In the history of science, Descartes has often been associated with the revival of ancient Atomism, but he did not maintain an atomist view of matter. Descartes defined material substance purely in geometric terms: matter was the thing which has extension in space. As space was infinitely divisible, it could not consist of indivisible objects. The identity of matter and space, the metaphysical foundation of the Cartesian system, leads to the rejection of void, i.e., a space that contains no matter, which is a prerequisite for atomism. It also leads to the conclusion that the infinite world consists of the same matter throughout. A vacuum which contains no matter, is a contradiction and consequently an impossibility for Descartes.[13]

The great philosophers of antiquity, Plato and Aristotle, were also firmly against atomism. When advocating the importance of form they considered Democritus' mechanical idea of "dead matter" too narrow to cope with phenomena related to living systems. Their idea of matter rather resembles the undifferentiated *apeiron* proposed earlier by Anaksimandros. Plato made a distinction between an eternal world of ideas and the changing sense-world that could appear in various forms, depending on the ideas that influenced

[8] Nagel 1962, 158-171.
[9] Mach 1883.
[10] Trusted 1991, 94-97.
[11] White 1998, 38-39.
[12] von Wright 1987, 46-48.
[13] Descartes 1996, 89,99,107. Dijksterhuis 1986, 405,409.

the unformed matter. Every being appearing on the sublunar world was a combination of matter and form.[14] For his disciple, Aristotle the basis of material being was *materia prima*, an indestructible substratum which was common to all elements. This material without qualities could not exist as such. Existing were the substances that came into being when the substratum was joined to any of two basic opposites, wet or dry, hot or cold. Aristotle also believed that matter could be divided without limit. According to him, the atomists' presumption that there were limits to the division of matter was in contradiction to the transformation of particles. When an entity moved from a state in which it had relatively less form to a shape in which it had more form, it was a question of potentiality becoming actuality. Substances always had the potentiality to the extent that they could become a particular form: when a substance had actuality, it had acquired a certain form.[15]

Modern notion of continuity based on waves

The explanatory value of particles diminished in physics along with the introduction of the concept of fields which are continuous entities filling up their space. Michael Faraday in 1849 was the first to use the term "field" which James Clerk Maxwell adopted in his electromagnetic theory. He discovered that waves in these fields propagated at a finite speed. Einstein employed field equations in general theory of relativity in 1927, and Paul Dirac introduced quantum fields where particles are considered to be quanta in these fields. Quantum physics completely ruined the particle-mechanistic paradigm of classical physics, the atomistic idea that all real happenings, in reality, could be reduced to eternal particles moving in space-time. Waves came into the forefront in physical explanations.

When trying to understand the new situation in physics at the beginning of the twentieth century, the Copenhagean founding fathers of quantum theory tracked the difficulties in interpretation down to the increasingly abstract nature of the theory. Everything that measurement could reveal from the investigated system was supposed to be contained in the wave or state function, but the nature of this mathematical construction remained unclear as it did not appear to have any distinct counterpart in observable reality. As the significance of mathematics increased, the concept of matter became more abstract. Elementary particles, such as, protons, electrons and photons were not eternal and unchanging. Rest mass changed to energy in collisions, and kinetic energy became mass in pair formation. The structure of regular particles appeared to be specified on the basis of conservation laws and fundamental symmetries in nature. The Copenhagen group along with Werner Heisenberg concluded that the increased immateriality (entstofflichung) of elementary particles meant that the concept of 'dead matter' customary in our world-view was to be replaced by a kind of interplay of forms. Niels Bohr considered that the first step in this direction had already been taken by the theory of relativity in its equivalence between mass and energy. He emphasized contextuality and criticised atomism in very much the same way as Plato and Aristotle:

"The discovery of the elementary quantum of action revealed a feature of wholeness inherent in atomic processes which goes far beyond the ancient idea of the limited divisibility of matter."[16]

In his popular book *Physics and Philosophy*[17], Werner Heisenberg indicated that the description of the world was going through the same type of change that took place in Antiquity when the atomist teachings

[14] Platon 1982, 194-195. (50c-e)
[15] Kallio-Tamminen 2004, 48-52. Aristotle 1984.
[16] Bohr 1963, 2.

of Leucippus and Democritus were replaced by the ways of thinking employed by Pythagoras and Plato, in which form was a more important factor than matter. Even though the final shape of a situation could not yet be achieved, Heisenberg felt able to express his belief that Plato's philosophical concepts were more suitable for addressing reality than proposals made by the antique Materialists. Moreover, the Aristotlean terms 'form' and 'content' or 'form' and 'substance' were given new meaning, since the elementary particles of modern physics were neither eternal nor unchanging particles of matter, but abstractions in the same way as Plato's regular elements consisting of triangles. In Heisenberg's view, elementary particles were different forms in which energy could be manifested. The result of their collision was not an object but a form which energy could take and which we then observed as being a material object. Energy was not just the force which kept everything moving, it was like fire in the philosophy of Heraclitus – the fundamental substance out of which the world is made.[18]

Max Born also emphasised mathematical forms or structures: in his opinion, particles were not something that could "in a Kantian manner be thought of as having substance".[19] Schrödinger, who considered waves to be more important than particles, also joined this discussion. He thought of the accurately specified masses and charges of particles as nothing more than gestalt-elements specified by wave equations. Individual particles were of no significance, since they were not identifiable as individuals. The same particle could never be observed twice, nor could a specific electron, even in principle, be considered to be labelled without resulting in errors in calculation. On the other hand, it was easy to leave a permanent trace in wave structures which could be observed more than once.[20]

However, on the basis of quantum theory it was not possible to carry out wave description completely. The multi-dimensional wave packets that describe the studied systems depended on the chosen group of observables in the experiment, and soon dissipated because of the different velocities of the component waves. Physics had to be content with wave-particle dualism which left the nature of quantum entities unclear, and consequently the conception of reality vague. The deep interpretative questions raised by the Copenhageans were not settled but faded into oblivion until recently when the 'the second spring' of quantum physics arrived. New technologies in fast-developing fields of quantum simulation and quantum information processing succeed in manipulating coherent quantum states. Researchers are utilizing the most unexpected and inexplicable quantum features like superposition and entanglement when creating innovative new constructions and realizations like supersensitive detection or artificial photosynthesis. Physicists today largely admit that a wavefunction has to be something "real". It is considered a mundane object that does not differ much from a bus schedule.[21] However, physicists are not able to provide an ontological explanation of what this unobservable entity, that does not fit into the context of classical (meta)physics, is or where it comes from.

Natural philosophy: strive to understand the nature of reality

Many of the fundamental questions now under evaluation were discussed already in the circles of the pre-Socratic natural philosophers. Their quest found a long-lasting consensus in Aristotle's physics and

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[17] Heisenberg 1958.
[18] Heisenberg 1958, 15-19,31. March 1957, 117-122.
[19] Born 1983.
[20] Schrödinger 1961, 53-56.
[21] Prof. Risto Nieminen in LFS seminar in 27.11.2018.

metaphysics.[22] As Heisenberg noticed, quantum phenomena would also be much easier to understand in Aristotle's world, where abstract forms and potentialities may emerge to the material level. The same fundamental questions need to be answered again whenever established presuppositions at cultural turning points lose their plausibility. According to Kuhn metaphysical considerations are prominent when new paradigms are coming into existence. Natural philosophy bloomed in ancient Greece and at the turn of the modern era when modern natural science had its beginnings. Along with the decline of the Newtonian framework, work in this fundamental field is once again stimulated. There is a demand for a more trustworthy map to navigate in the world.

In their attempt to understand the nature of reality, philosophers in this field have since antiquity tried to move from phenomena to factual, from transformations to eternal laws, from perception to pure understanding. The Milesian school that bloomed in the 6th century BC is known for initiating the search for natural causes and explanations. The early philosophers looked for a single fundamental substance or principle out of which everything was formed, something which ruled all occurrence and could explain the colourful variety of the myriad phenomena that we observe. Heraclitus saw that the diversity of reality could not be reduced to anything material as the material world was not permanent. There was a continuous change going on everywhere. Nobody could step into the same flow twice as today's river consists of different water than yesterday's. Heraclitus understood that in addition to Being, the question of Becoming also demands a solution.

Pythagoras emphasized the power of numbers and mathematics. In the Pythagorean doctrine, mathematics and numbers took a position similar to that of basic matter for the Milesians. The ultimate basis was an ideal principle of form, proportions and measures, that could not be sensed as water in the philosophy of Thales. Forms and numbers represented a deeper order, harmony, hidden behind visible phenomena.

The Elean approach to fundamental truth followed Parmenides who laid his trust on logic. Logic proved, that something that already existed could not change into something which it was not. Thus one could not become many, and that which was static could not begin to move. Movement, change and multiplicity had to be virtual and subjective. Senses were a poor witness compared to logic which revealed true being to be one and unchanging. Atomists with their idea of eternal atoms moving and mingling with each other in empty space attempted to unite the idea of primary substance to Parmenides' argument which rejected change and multiplicity.[23]

In the study of the ultimate questions related to nature all these ancient aspects of inquiry: substance, change, mathematics and logic, are still important. At the turn of the modern era special stress was put on empirical truth, what actually could be observed and measured. When Galilei combined the atomist outlook to the strict mathematical method inherited from Pythagoras and Plato he especially asked for factual relationships, i.e., how change actually takes place. Metaphysics disappeared under the empiricist practice. Aristotelian terms related to substances, their unseen essences and potentialities were discarded from explanation. The new method proved unprecedentedly successful, and the particle-mechanistic world-view was for centuries believed to correspond to reality, at least at the material level.

[22] Aristotle 1984.
[23] Kallio-Tamminen 2004, 24-41.

More detailed research in modern physics, however, revealed new facts that challenged the uttermost metaphysical principles adopted along with the Newtonian physics: atomism, determinism, reductionism, and the detached observer. Especially the difficulties related to the interpretation of quantum phenomena, disclosed the need for deep ontological and epistemological re-evaluations. Natural philosophy entered into its third ”golden age”. As the metaphysical problems have not yet been solved despite almost one hundred years of discussions, the scope of occurring change appears to parallel that of the earlier revolutions.[24]

Whatever the ontological status of numbers may be, the development in modern physics has proved the value of mathematics in capturing essential shapes in the fabric of reality beneath visible phenomena.[25] When the illusion of the objective reality of elementary particles in a peculiar way disappeared along with quantum physics, something that is concrete and tangible was lost to the transparency of mathematical clarity. There are no mathematical problems when dealing with unexpected quantum phenomena. New findings just cannot be explained within the prevailing mechanistic-deterministic framework in a plain comprehensible manner. The success of mathematics does not mean that the accustomed ontological approach, asking for basic substance and causes for its division and movement, is futile. Abstract mathematical structures as such are not enough for physics. To genuinely illustrate reality, an operationally satisfactory mathematical theory that conforms to observations, should render a univocal interpretation.

Since the time of the Copenhageans in the first half of the twentieth century, a variety of further interpretations explicating the unexpected quantum facts has emerged. Each of them holds different presuppositions and imply different kinds of surprising changes to the world view, such as active information or branching universes.[26] There is no obvious choice between conflicting metaphysical views; the very existence of several imaginative conceptions can rather be seen just as manifestations of the failure of the central ideas of mechanism and materialism assuming that all causes could be reduced to properties and relations between material things.

When interpreting quantum phenomena many researchers, in addition to similarities to antiquity, have found it easier to explain them in the context of eastern philosophies where mind and mental influences are not disconnected from material reality. Especially the notorious ’measurement problem’ evoked the concept of consciousness to be included in the vocabulary of physicists. The idea of a detached observer was already criticized by Bohr who repeatedly depicted the epistemological problems to be similar to those which thinkers such as Buddha and Laotse encountered when attempting to balance our position as both observers and actors in the great drama of existence.[27] People are immersed in the world which they strive to understand to the best of their ability.

When aiming to provide a proper ontology for the mathematical theories, a new view of physical reality, the nature of basic substance or substances is fundamental. Related to quantum phenomena, it has often been suggested that the basic substance may not be matter but something psychophysical, something that supports material as well as mental phenomena. This is a customary assumption in Eastern philosophies, and a possible option as soon as Cartesian dualism or materialistic atomism criticized by Plato and Aristotle are discarded. When in principle allowing some kind of panpsychism, empirical science has advanced to a

[24] Kallio-Tamminen 2004, 57.
[25] Kallio-Tamminen 2004, xx
[26] Kallio-Tamminen 2004, 242-251.
[27] Bohr 1958, 19-20. Kallio-Tamminen 2002.

level when the very ideas – the ideas of dualism and materialism that originally legitimated its field of study, but blurred proper comprehension of mental phenomena – can justifiably be surpassed.

An ontological approach was significant in the profound re-evaluations that happened in antiquity and at the turn of the modern era. Along with the increased abstractness of the theories in contemporary physics, their ontological content has diminished, and they are often considered to be just operational tools rather than realist portrayals corresponding to reality. Ontological starting points have also been criticised in philosophy for the problematic presuppositions associated with the whole endeavour. VIITE Whenever there is an attempt to understand the world as the differentiation of some primary substance or element, it is necessary to postulate this substance as being the basis for all appearing things. The first result of this is the question of how a clear conception of this maybe non-visible primary substance can be formed simply by thought. Secondly, it should be possible to present a credible explanation of why and in which way this homogeneous primary substance differentiates exactly into the world that we observe.[28]

Formulation of a plausible world-view, finding the genuine causes and physical processes that are underlying the readily observed phenomena is a creative task. It cannot be arbitrary but it certainly is not any straightforward process either. The enterprise demands rigorous study, an appropriate mathematical model capturing the whole spectrum of observations, and considerable philosophical talent to provide a sound conceptual formulation. When cultivating a further understanding of the universe, an appropriate mathematical model is indispensable but one cannot be content with just mathematical simulation. A model example of elusive mathematical self-deception were the epicycles in Ptolemian celestial mechanics. These mathematical complications turned out to be unreal within the Copernicanian heliocentric system. When the Earth was no more assumed to be in the centre, plainer mathematics sufficed to take in more physics. A proper viewpoint whose discovery would not have been possible without original thought, revealed an unseen new structure including further causes and interconnections. Metaphysics helped to get rid of the blinding spell of just a mathematical theory based on immediate observations. The role of innovative thought in extending knowledge can not be underestimated.

Physical understanding related to the basic principles of reality has not proceeded much for the last hundred years as unification of the theories of relativity and quantum physics has not succeeded. There are attempts at formulating an all-encompassing ultimate theory of everything in physics but these multidimensional mathematical edifices cannot be validiated by empirical tests. They remain beyond tangible comprehension and cannot capture a complete outlook to reality. It seems quite an impossible task to find a perspective from which to join together the theory of relativity where bodies are moving in 4-dimensional space-time whose structure is being modified according to their presence, where time and length are apt to vary depending on an observer's position and state of motion, and quantum mechanics where the unobservable systems follow wave-mechanics in complex, multidimensional Hilbert spaces, but reduce into quite ordinary entities whenever observed in the accustomed 3-dimensional space.

In the light of history, proper unification may not succeed based on pure mathematics. The present trend for mathematical abundance might be reduced by a fresh metaphysical context which could disclose some until now unnoticed fundamental interrelations by providing a deeper view into the universe. Tuomo Suntola's 4-dimensional zero-energy model, the Dynamic universe (DU) contains the required kind of primary principles. This truly revolutionary theory unifies the domains of theory of relativity and quantum

[28] Collingwood 1960, 40-43.

physics, and unlocks the mathematical complications by introducing a more thorough perspective on the cosmos.

In spite of its obvious merits, this unequalled solution has not been widely acknowledged among professional experts. It may be considered too strange or too good to be true. As we have learned from Kuhn, it is not a painless task to assimilate a completely new theory package which does not conveniently fit into one's previous lines of thought.[29] Guidelines for evaluation, however, are provided in the philosophy of science whose criteria explicitly state we are approaching truth whenever a more encompassing theory can be built on a smaller number of premises.[30] It is known that a major paradigm change inevitably entails a new theory that is incompatible with the earlier ones. Things are to be seen in a new context.

DU – transparent framework for wider conception of reality

The recipe for successful unification in Suntola's theory is a spherically closed space in 4 metric dimensions and the zero-energy principle which are both reliable and well-known principles in physics. Their throughgoing integration generates a structure and dynamics for physical reality where time and lengths may maintain their shape and bodies can be constructed out of waves. In addition to its great value for physics, the framework is indispensable for constituting a comprehensible picture of reality. It provides a justified answer to many age-long disputes in natural philosophy starting from the basic substance of being, origin of movement, possibility of empty space and the character of mass, inertia, energy, and their relations. Most importantly, the context does not exclude human beings or flatten them into automatons, but allows us a responsible position to participate to some extent in structuring the scheme of things.

According to the principles of DU, our 3D space is the surface of an 4D sphere that is expanding through a 4D universe at the speed of light along the radius of the sphere. The surface is no empty space but intrinsically contains a certain amount of mass which has gained motion because of its own gravitation. The original amount of mass is conserved in the subsequent evolution process where the abstract, formless mass presents itself when energized. The energized thing that results from the primary foremost movement that takes place along the radius of the 4-dimensional sphere is customarily called 'rest mass' in the 3D space. It is further structured in the subsequent zero-sum process of motion and gravitation, and naturally evolves into all the phenomena and multilayered cascades of structures we observe in space. In the process, the gain of motion in the system is always counterbalanced by the release of gravitational potential energy.

In its quest for a coherent picture of the whole reality, DU attains a discovery that is analogical to that of Copernicus. In a broader ontological framework many present concepts, such as dilated time, contracted length and dark energy, turn out to be just epicycles. These illusory accounts are no more needed in a more encompassing theory. Being inhabitants in a 3-dimensional world, we are not able to notice the 4th dimension or the fundamental movement happening at the speed of light into the direction that is perpendicular to all directions in space. Yet the 4th dimension and the movement are presented to be real, and in the wholistic system they provide a reference to all subsequent frames and movements in space whether seemingly in motion or at rest. It may be against everyday observation, just like the earth moving

[29] Kuhn 1970.
[30] Styrman 2016. When evaluating DU and Relativistic physics (RP) Styrman concludes that DU match perceptions at least as accurately than RP and is metaphysically more unified and virtuous. p. 124-128.

around the sun was against what was considered possible at Copernicus' time. Copernicus refused to publish his thoughts until the very last days of his life since among the uninitiated they might only arouse mockery. He could only plead for his theory yielding a simpler and more harmonious mathematical order for the facts. Despite the turmoils of the time and the ban set by religious authorities, this subtle truth was enough to initiate a revolution.

Contrary to the standard theories that are based on local observations and their extrapolation, DU boldly starts from totality which in its entirety cannot be directly seen but is securely discernable by meticulous inventive thought. The result is a more encompassing theory which does not seamlessly fit into the previous lines of thought as it is built on a smaller number of premises. This is an obvious merit according to the criteria established in the philosophy of science. The consistent theory does not need any ad hoc hypoteses for its predictions to fit with the observed results in physics and cosmology. Because of its clear principles and transparent mathematics, the theory can be easily interpreted, like Newton's synthesis at its time. The precise and lucid model includes an obvious ontology which can be spelled out into an unambiguous and understandable interpretation.

When turning the Newtonian clockwork into a pendulating 4D-sphere, DU further clarifies the basic Newtonian terms of force, motion, mass, and inertia. Especially DU's consistent composition profoundly enlightens the nature of mass, its abstract essense, and terms of evolution and division into various kinds of entities. Newtonian mass was a kind of constant, 'the quantity of matter in a body' whose origin remained a mystery. DU gives an explanation for gravitation and inertia by recognizing mass not just as a certain feature in all bodies, but the origin of all existence. Mass is an abstract quality that cannot be seen if it is not energized. As such, it is a hidden basis of everything, the foundation of all existence which becomes tangible in energization. Because of gravitation, mass entails movement and provides potentiality for everything to actualize, for an evolving universe to manifest.

In DU all the remnants of the particle-mechanistic thinking adopted at the beginning of the modern era are embedded into genuine holism that permeates everywhere and ultimately connects everything. The ideas of atomism, mechanism, and materialism are innately surpassed in this dynamic synthesis that venerates the holistic way of thinking typical in ancient and eastern philosophies. The universe with its laws is seen as a 4-dimensional self-organizing entity, a flexible process where nothing that ever exists is disconnected from this magnificent entirety. This integrated conception is in line with the conviction of Copenhageans that the concept of dead matter in our world-view is being replaced by a kind of interplay of forms. The demand for wave-particle dualism can also be given up.

Particles become secondary constructions as DU manages to carry out a ubiquitous wave description by noticing that Planck's constant contains an inbuilt term *c* (speed of light) which shall be removed. The matter waves suggested by de Broglie wave can then be described as a mass wave carrying the momentum of a moving mass object – much in the way de Broglie was looking for. In DU's formalism mass waves propagate at the velocity of light whereas the velocity of structured bodies in space is v. The thorough wave description grants an obvious explanation for many apparent paradoxes in quantum theory starting from Young's double slit experiment. The theory thus completes the aspiration of Erwin Schrödinger[31] and others for a comprehensive wave description. In this kind of context ultimately composed of elusive waves it is easy to admit that the wavefunction is a "real" mundane object as physicists today often do, even if the

[31] Schrödinger 1961.

ontological nature of this unobservable entity which does not fit into the context of the Newtonian world view is not really known.

When leaving behind the idea that things would ultimately consist of separate particles existing in empty space, the whole still is a lawful but more flexible system. The dynamic solution implements continuous change. It unveils the unique historicity in everything that is manifesting thus celebrating the vision of Heraclitus. Nobody can ever enter the same river twice. The universal laws determine the energetic conditions for everything that exists and possibly might exist. When energized via motion, mass presents itself in a wavelike mode whose precise form depends on the characteristics of the energy. Waves carry out interference and modulation in their course, which means that various kinds of signals may be genuinely united. There is room for things to change. Various kinds of coincidences and internal tendencies may influence the self-organization that is happening in the cascaded subsystems. This pertains also to the circumstances humans are living in.

In DU's holistic framework any motion or state of rest in space are always associated with the motion of space in the fourth dimension. In spite of the invisibility of the 4th dimension, its metric nature fits better to the categories of human perception than the Einsteinian space-time that mixes up the quantities of space and time, the traditional coordinate system. Energy and mass should also not be equalized although all forms of energy are originally derivable from mass and its movement in 4th dimension. The theory endows mass equivalence for electromagnetic radiation and Coulomb energy that influences all charged particles. According to Maxwell electromagnetism can be described on the basis of kinetic energy and potential energy. In principle, there might also be more subtle forms of energy which could manifest themselves when systems grow more complex.

When looking for a place for spiritual phenomena the greatest philosophers could not accept that everything consisted of separate particles moving in empty space. In DU the abstract forms that Plato and Aristotle highlighted can be described via the interplay of energies. There is once again room for the Aristotelian kind of terms related to the essences of substances, their unseen reservoirs of potentialities for actualization. Every being appearing on the sublunar as well as the supralunar world turns out to be a combination of substance and structure that is formed in a definite historical process. *Materia prima* cannot exist as such but will appear when energized by any of the two basic opposites. Elementary particles are specific legitimate formations, fitting structures for energy to manifest.

The great rationalists Descartes and Leibniz argued for a full space consisting of continuous substance. The identity of matter and space which was the metaphysical foundation of the Cartesian system, leads to the conclusion that the infinite world consists of the same matter throughout. This fits nicely into the framework of DU. The world is not infinite but it contains everywhere mass which actually determines the whole space. Space and the gravitational potential field need not be separated. Through gravitation also local and global are seamlessly linked together. There is room for human beings to affect the course of evolvement. They live in a world where invisible and change are naturally present.

Conclusion

DU is a worthy candidate for constituting a solid basis for a revised conception of reality. The theory covers the present empirical knowledge and gives justified answers to the eternal questions investigated in natural

philosophy. When looking for a realistic ontological model which is based on qualitative thought, one cannot be satisfied with the empiricist tenet to accept any theory that is able to simulate the observations. This kind of critical attitude is indispensable for approaching a more reliable description of reality. An inventive synthesis respects human recourses in coping with our surroundings. An adequate theory is needed to increase our competence to live in harmony with nature.

By the zero-energy hypothesis and a metric 4th dimension, DU discloses a seamless connection between mass, space, motion, and energy providing an unprecedented solution to the age-old question in natural philosophy related to the basic substance and its division. The whole of existence is based on mass and its energization, which means that reality can be described as being psychophysical: it supports material as well as mental phenomena and binds them together. Further in the new framework, the age-old schism between materialism and idealism can be solved into a synthesis: particles and the zero-sum game of energy arise from one fundamental source. There is no ontological need for Cartesian dualism. This is in line with recent research on brain plasticity and the Operational Architectonics (OA) theory of brain-mind functioning that unifies brain and mind through nested and dynamic hierarchy of electromagnetic brain fields.[32]

As there is the possibility for subtle forms of energy in DU, the phenomena we call 'spiritual' or 'mental', need not be disconnected from the totality emerging from mass. The complex parts that emerge from the abstract whole in the pendulating entirety need not be lifeless systems. Human beings with all their features may be a result of natural evolution. Humans like everything else in the universe are born into certain historically determined frames that provide, as well as limit, the resources and possibilities that are available in given circumstances. Whenever humans use their resources to modify something according to their intention a new form may be said to enter into the substance employed. A potentiality becomes actuality. It is an unavoidable ethical challenge for humans to think of what to actualize.

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[32] Fingelkurts et al 2019.

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