

DOI: <https://doi.org/10.24297/jap.v22i.9682>**Momentum – the Archilles’ Heel of Causality-based Physics**

The Root of Its Miseries - from the Quantum to the Cosmic

Abdul Malek

Akadimía Ylistikís Dialektikí, 980 Rue Robert, Brossard, Québec.

Canada J4X 1C9

abdulmalek@qc.aibn.com

Abstract:

G. Galileo famously discovered the inverse square law of gravitation on earth and also formulated the concept of momentum as “ mv ” (mass x velocity) for the dynamics of moving bodies. But the momentum “ mv ” was at an odd with his inverse square law of “Fee Fall” as pointed out later by G.W. Leibniz, who gave the correct formulation of momentum as “ mv^2 ”. G.W.F. Hegel later showed that the momentum expressed as “ mv ” is incompatible with what he called, “the laws of absolutely free motion” discovered by Kepler’s three laws of the planetary system. However, in spite of the controversy raised by J. Kepler, Leibniz and Hegel; the continued use of “ mv ” as the measure of momentum of moving bodies in physics and dynamics since R. Descartes and I. Newton; until now, even after the recognition of the quantum phenomena at the turn of the 20th century; is leading to more and more mysteries and myths; impeding further developments in physics and cosmology.

It can now be shown that developments in Quantum electrodynamics and dialectics abolishes any notion of Newtonian mystery of “First Impulse” for matter and motion (momentum) from God. Leibniz’s formulation of momentum as “ mv^2 ” is more appropriate and its use can resolve many of the problems in modern theoretical physics and cosmology; including in extra-terrestrial dynamics of the heavenly bodies and gravitation, electrodynamics and in quantum electrodynamics. The recognition of Leibniz’s vis viva, Hegel’s “absolute dynamics” and momentum as “ mv^2 ” (“ mv^3 ” only for neutral quantum particles like light photons); would represent the end of all mysticism and myths of cosmology, created since Isaac Newton’s “negation” of the Copernican revolution; later reinforced and accentuated by Albert Einstein’s theories of relativity.

Keywords: Momentum, Causality, Dialectics, Astrodynamics, Cosmology, Electrodynamics, Quantum Electrodynamics

Introduction:

Historical Background: Frederick Engels in his book *Dialectics of Nature* [1] gave an eloquent description of this controversy and also gave hint to its possible resolution. So, it is worth quoting Engels, in some detail as shown below: “Galileo discovered, on the one hand, the law of falling, according to which the distances traversed by falling bodies are proportional to the squares of the times taken in falling. On the other hand, as we shall see, he put forward the not quite compatible law that the magnitude of motion of a body (its impeto or momento) is determined by the mass and the velocity in such a way that for constant mass it is proportional to the velocity. Descartes adopted this latter law and made the product of the mass and the velocity of the moving body quite generally into the measure of its motion.

Huyghens had already found that, on elastic impact, the sum of the products of the masses, multiplied by the squares of their velocities, remains the same before and after impact, and that an analogous law holds good in various other cases of motion to a system of connected bodies.

Leibniz was the first to realise that the Cartesian measure of motion was in contradiction to the law of falling. On the other hand, it could not be denied that in many cases the Cartesian measure was correct. Accordingly, Leibniz divided moving forces into dead forces and live forces. The dead were the “pushes” or “pulls” of resting bodies, and their measure the product of the mass and the velocity with which the body would move if it were to pass from a state of rest to one of motion. On the other hand, he put forward as the measure of vis viva, of the real motion of a body, the product of the mass and the square of the velocity. This new measure of motion he derived directly from the law of falling.

‘The same force is required,’ so Leibniz concluded, ‘to raise a body of four pounds in weight one foot as to raise a body of one pound in weight four feet; but the distances are proportional to the square of the velocity, for when a body has fallen four feet, it attains twice the velocity reached on falling only one foot. However, bodies on falling acquire the force for rising to the same height as that from which they fell; hence the forces are proportional to the square of the velocity.’ (Suter, *Geschichte der Mathematik* [History of Mathematics], II, p. 367.)

But he showed further that the measure of motion mv is in contradiction to the Cartesian law of the constancy of the quantity of motion, for if it was really valid the force (i.e. the quantity of motion) in nature would continually increase or diminish. He even devised an apparatus (1690, *Acta Eruditorum*) which, if the measure mv were

correct, would be bound to act as a perpetuum mobile with continual gain of force, which, however, would be absurd. Recently, Helmholtz has again frequently employed this kind of argument.

The Cartesians protested with might and main and there developed a famous controversy lasting many years, in which Kant also participated in his very first work (*Gedanken von der wahren Schätzung der lebendigen Kräfte* [Thoughts on the True Estimation of Live Forces], 1746), without, however, seeing clearly into the matter. Mathematicians to-day look down with a certain amount of scorn on this "barren" controversy which "dragged out for more than forty years and divided the mathematicians of Europe into two hostile camps, until at last d'Alembert [2] by his *Traité de dynamique* (1743), as it were by a final verdict, put an end to the useless verbal dispute, for it was nothing else." (Suter, *ibid.*, p. 366.)

The expression 'vis viva' has endured up to the present day; as Engels further noted, "And in point of fact, how is it to be understood that motion has two contradictory measures, that on one occasion it is proportional to the velocity, and on another to the square of the velocity? Suter makes it very easy for himself; he says both sides were right and both were wrong" This confused stance of Suter was later opportunistically adopted by d'Alembert; who swept the controversy under the rug, like "renormalization" in modern quantum electrodynamics (QED); where it still remains! d'Alembert's "final verdict"; which still rules mechanics and physics, was based on spurious justification and says, the whole question does not occur, on account of "l'inutilité parfaite donc elle est pour la mécanique". This may be true for purely mathematical mechanics; but as would be shown later on; for REAL mechanics, the problem is still alive and vulnerable, like Achilles' Heel!!

Results and Discussion

Matter and Motion:

Leibniz's concept of 'vis viva' was later reinforced by G.W.F Hegel, who in his dialectical philosophy of space and time, for the first time in history, gave a scientific and rational basis for ontological origin of matter and motion (i.e., momentum). For Hegel, matter particles with absolute free motion and in its most elementary particle forms come into being and passes out of existence as "Being-Nothing" - the result of the resolution of the contradiction of abstract space and abstract time and are the primary elements of any physical/material existence. Ironically, "Being-Nothing" is the most scientific and revolutionary aspect of Hegel's idealist philosophy, the significance of which, even the materialist dialectics of Marx and Engels could not appreciate; because at that time there was no scientific basis for such speculative notions. This is also probably because classical materialism still had a strong influence for dialectical thinkers of that time, specially on the questions of Nature. Engels, who focussed the most on natural science, confined himself to quoting passages of Hegel's writing on space and time in his book "Dialectics of Nature" [1]; without any further elaboration. V.I. Lenin was even highly critical of Hegel's abstract and "idealist" speculation.

Hegel arrived at the contradiction "Being-Nothing" by an extraordinary extension of his dialectics and in a very obscure and highly speculative way; guided by "pure reason" and his patent - "the portentous power of the negative". Such speculative thought was/is impossible in causality-based epistemology of Metaphysics, for which only dumb isolated "Being" or a meaningless "Nothing" is possible; without any relation to each other. For the latter view, matter and motion can come only through the "First Impulse" from God and is a perpetual mystery. If an epistemology starts from a mystery and/or ends in a mystery; it can hardly be called scientific! The ontological question of the world shows the superiority of Dialectics as a scientific method over Metaphysics, in a profound way; which is reflected in all branches of science in general; theoretical physics and cosmology in particular.

It is only now, after the recognition of the quantum phenomena, that the profoundness of Hegel's speculative philosophy of space and time become evident. The contradiction of abstract space and abstract time is represented by the contradiction "Being-Nothing" of the quantum vacuum; where virtual particles of elementary matter-antimatter pair momentarily and eternally pop in and go out of existence; in this infinite, eternal and ever-changing universe [3]. The virtual particles can become real particles either through quantum tunnelling and/or when sufficient energy for their mass and motion (i.e., momentum) becomes available. The quantum vacuum is therefore, the source and sink of all "real" matter in eternal motion [3]. This absolute free motion, which Hegel called absolute dynamics, refers only to the elementary particles in their free state. In aggregated forms like in atoms, molecules or larger matter particle; the mass and the absolute motion of the elementary particles' forms, are averaged out and mediated by gravitational, electromagnetic, weak and strong nuclear forces. But after a quantized mass formation of matter in free units of atoms, their mass remains invariant; but their absolute motion at creation becomes mediated by the external forces. So, for Hegel's dialectics, motion is the mode of existence of matter and is its intrinsic property. There can be no matter without motion and no motion without matter [3]. Separately chance accumulated real matter and antimatter particles give rise to the larger tangible structures from the planets to the galaxies and their clusters, in this infinite, eternal and ever-changing universe [4,5].

The dialectical view of matter and motion sharply and fundamentally differ from that of Cartesian/Newtonian dynamics, as Hegel [6] distinguished the two in the following way: "Because the forces have been seen as only implanted onto matter, motion in particular is considered to be a determination external to the body, even by that physics which is presumably scientific. It has thus become a leading axiom of mechanics that the body is set in motion or placed into a condition only by an external cause. On the one hand it is the understanding which holds motion and rest apart as nonconceptual determinations, and therefore does not grasp their transition into each other, but on the other hand only the selfless (lifeless, A.M.) bodies of the earth. which are the objects of ordinary mechanics, appear in this representation".

As we would see later on, these two distinct and opposite views of matter and motion, characterized by Hegel as "the view of understanding" or Metaphysics and "the view of reason" or Dialectics, respectively; pervades all aspects of the historically developed sciences of Nature and Man. For Metaphysics (Causality), the opposite categories exist as absolute, immutable, invariable and unchangeable polar formations since their creation by God, separated by an impassable barrier of the "excluded middle" of Aristotle. For this world-view; everything existing are created (by God) "perfect-in-itself"; and only exist in space with no change or development in time. As Hegel pointed out, this view holds the opposites as "nonconceptual determinations, and therefore does not grasp their transition into each other". This inability to grasp the transition from "rest" to "motion" (i.e., between the opposites in general) without a cause or force from God; is the Achilles' Heel not only in the case of momentum; for Causality-based physics, but of its world-view in general. For dialectics, on the contrary, the opposites always exist together in a contradiction of the "unity if the opposites". i.e., in a logical conflict or contradiction, at the very element of any existence. The successive resolution of the contradictions, at all levels of material/physical existence is what gives rise to the phenomenology of the infinite, eternal and ever-changing universe. "Being-Nothing" represents the first and also the last contradiction of any material/physical existence.

The momentum represented by " mv ", which Leibniz termed the "dead force" on or near the surface of a cosmic body like the earth; is a conditionally arrested part of the vis viva momentum of a freely existing body, due to gravitational attraction of the earth and physical resistance caused by other "dead forces" and other factors such as resistance on earth. But when the body is progressively moved to outer space, vis viva comes into play. Newton, unscientifically transferred the inverse square law of Galileo (L/t^2), where L is the distance traversed in time t in ordinary dynamics, but valid only on the earth; to astrodynamics. In the solar system; where Kepler's laws and absolute dynamics is in operation; this relation is represented by L^3/t^2 . The ratio ($L^3/t^2/L/t^2$) or L^2 or the momentum mv^2 , represent the vis viva of Leibniz and L^3/t^2 the absolute dynamics of Hegel, respectively [7,8]. Light photons (in the whole range from microwave to gamma ray) which caused unfathomable confusion in modern physics since Einstein, are unique and distinct matter particles that exist only as real absolutely free particles with characteristic and invariable mass, which is inversely proportional to the cube of their absolute velocity. In their confined state in stable atomic matter particles and in the quantum vacuum; photons exist as virtual particles. Real photons are created instantly from their virtual state, through quantum tunnelling and/or when enough energy equivalent to their mass and velocity are available. The mass of the absolutely free photons is proportional to the inverse cube of their velocity [8,9].

Hegel described the difference between Kepler's and Newton's laws of motion in the following way [10]: "On closer inspection it appears that what Kepler, in a simple and sublime manner, articulated in the form of laws of celestial motion, Newton converted into the nonconceptual, reflective form of the force of gravity. The whole manner of this "proof" presents in general a confused tissue of lines of merely geometrical construction to which a physical meaning of independent forces is given, of the empty concepts of the understanding of a force of acceleration, of particles of time, at whose beginning those forces always play a renewed role, and of a force of inertia, which presumably continues its previous effect, and so on. A rational proof of the quantitative determinations of free motion can only rest on the determinations of the concepts of space and time, the moments whose relation is motion".

Hegel noted further [11]: "By contrast, in absolute motion there is the relation in its totality, since this is the realm of free measures in which each determinacy attains its totality. Because the law is essentially relational, time and space are retained in their original difference. Dimensionless time achieves therefore only a formal identity with itself; space, on the other hand, as positive being outside of itself achieves the dimension of the concept. The Keplerian law is thus the relation of the cubes of the distances to the squares of the times; - a law which is so great because it simply and directly depicts the reason of the thing. The Newtonian formula, however, which transforms it into a law for the force of gravity, exhibits only the perversion and inversion of reflection which has stopped halfway".

The use of " mv " as momentum in ordinary mechanics on or near a celestial body like the earth is satisfactory enough for everyday life and technological purpose, only because of the fact that the vis viva and absolute mechanics is

suppressed by the dominant gravitational attractive force, resistance etc., on the earth; however, in space exploration technology, it is Leibniz's vis viva equation, not Newton's law that needs to be used. Also, as would be shown later, the continued use of "mv" in the macrocosm of astrophysics and cosmology, specially after Einstein's theories of relativity, have led to the notions of unphysical and absurd things and processes and a new "scientific" mythology of Big Bang creation. And in the realm of the microcosm of electrodynamics and quantum electrodynamics, where the suppression forces of terrestrial Nature have minimum effect, the use of "mv" instead of "mv²" have led the mysteries of "hidden momentum"; in reality representing Leibniz's vis viva.

It now seems clear that after the Copernican revolution threatened Theology, class rule and the remnants of feudal power; the emerging power of capitalism made the unholy alliance with the prevailing decadent ruling ideas for promoting and imposing Newton's false theory of universal gravitational attraction; in spite of the brilliant scientific contributions of Kepler and Leibniz. Even Hegel's profound scientific and ontological intuition of the contradiction of abstract Space and abstract Time; giving rise to matter and motion, and which even anticipated the quantum phenomena, long before its discovery; only fell on hostile soil without any germination. Had the dialectical approach of Kepler and Leibniz prevailed over the Metaphysics and theology of Newton masquerading as science; theoretical physics and cosmology in particular and humanity in general; would have been far ahead scientifically and would have been saved from going in the wrong direction. Theoretical physics and cosmology would have been spared of the ideal mathematics-derived fantasies, mysteries and the miseries of the last few hundred years; continuing to the present time of history, and only reinforced by Einstein's theories of relativity.

Astrodynamics and Gravitation:

As the discussion above shows, Hegel's "absolute dynamics" working in the celestial realm is very different from "ordinary dynamics" applicable only on or near the surface of any cosmic body like the earth. Gravity, like anything else in the universe is a contradiction of the unity of the opposites, i.e., of simultaneous attraction and repulsion and resolves this contradiction in the manifestation of the material bodies like the planets, stars, galaxies etc. of the universe. Hegel [12] defined gravity in the following way:

"Gravitation is the true and determinate concept of material corporeality, which is thereby just as essentially divided into particular bodies, and which has its manifested existence, the moment of external individuality, in movement, which is thus determined immediately as a relation of several bodies. General gravitation must be recognised for itself as a profound thought, which constitutes an absolute basis for mechanics if it is conceived initially in the sphere of reflection, though it is so bound up with it through the quantitative determinations that it has attracted attention and credit, and its verification has been based solely on the experience analysed from the solar system down to the phenomenon of the capillary tubes. Certainly, gravitation directly contradicts the law of inertia, for, by virtue of the former, matter strives to get out of itself to another... Matter in itself holds itself apart from itself through the moment of its negativity, diversity, or abstract separation into parts; it has repulsion. Its being apart from itself is just as essential, however, because these differences are one and the same: the negative unity of this existence apart from itself as being for itself, and thus continuous. Matter therefore has attraction. The unity of these moments is gravity."

Ordinary dynamics and its ideal mathematical representations are the results of historical and social practice at human scale in terrestrial Nature and have scientific basis as approximate positive knowledge. But there is absolutely no reason or basis in the idea that extending this knowledge far in the realm of the macrocosm of the galaxies and the microcosm of the quantum world; would give similar results and positive knowledge! But Newton did exactly this in his physics, to keep the mystery of God's "First Impulse" and the manifestation of ideal mathematics in the affairs of the physical world. This is evident in the very first sentence of the Foreword [13] of Newton's Principia, "Now that (since Bacon) the substantial forms (of the Aristotelians) have been abandoned from natural philosophy, mathematics should replace them to the maximum possible extent." It is evident that Newton clearly rejected materialist and conceptual (Begriff) methods of philosophical enquiry of Aristotle in favour of the mathematical idealism of Plato and Ptolemy's epicycles; which posits that mathematical forms define the phenomenology of objective reality or at least the phenomena described by the sciences have a mathematical structure. Newton thus idealized and elevated empirical experience and knowledge to the realm of ideal mathematical abstraction and the thought world; rejecting philosophical notions as metaphysics. Hegel tauntingly wrote [14] "Newton gave physics an express warning to beware of metaphysics, it is true; but to his own honor, be it said, he did not obey his own warning".

Engels [15] succinctly descried British empiricism in the following way, "It is the old story. First of all, one makes sensuous things into abstractions and then one wants to know them through, the senses, to see time and smell space. The empiricist becomes so steeped in the habit of empirical experience, that he believes that he is still in the field of sensuous experience when he is operating with abstractions". Hegel in the Preface of his "The Phenomenology of Mind"

similarly berates Newton's theory of gravitation and mathematical knowledge in general as abstract and hollow. For him [16], "In mathematical knowledge, the insight required is an external function so far as the subject-matter dealt with is concerned. It follows that the actual fact is thereby altered. The means taken, construction and proof, contain, no doubt, true propositions; but all the same we are bound to say that the content is false... The real defect of this kind of knowledge, however, affects its process of knowing as much as its material".

For Hegel, "The element of truth is the Concept/Notion (Begriff), and its true form the scientific system." And also, the reason behind his famous statement, "Truth in philosophy means that concepts and external reality corresponds". There could be no better statement about scientific and objective truth. Following the works Kepler, Leibniz and Hegel, this author has shown [7,17] that Newton's theory of universal gravitational attraction is defective and the whole cosmology build so far on it; is false and mere fantasy; with little basis in objective reality. A quantitative expression for the gravitational potential [7]; eliminates the need for "Big Bang" creation, dark/black entities and the whole narrative of modern official cosmology. This author has also shown [18], how this centuries-long fantasy Metaphysics arose and justified and maintained by official science.

It is a historical truth that the more abstract the ideas and theories are, the more they borrow from the ideology of the prevailing ruling class. This is exactly what has happened with official theoretical physics and cosmology, under capitalist rule, and now in its moribund monopoly form; mathematical idealism has been taken to its epitome by Einstein [19], seeking the final and absolute truth of a unitary God of theology. These mathematical abstractions have been taken to such a ridiculous level by modern official theoretical physicists; is the reason why for them "Matter is a Myth" and why a prominent members of official theoretical physics would write book titles [20] like, "Our Mathematical Universe", etc., ad nauseam.

Electrodynamics:

This is another subsection of physics, where Causality and Metaphysical epistemology and the use of momentum as "mv" have led to enormous confusion and mysticism, specially in cosmology; even though the recognition of electromagnetism in Nature has led to extensive technological development. J.C. Maxwell's theory of electromagnetism [21] was based on the great discoveries and the understanding of the electric and magnetic phenomena in Nature, specially by the time of 19th century. It was based on historical/social practice of man and hence represent positive knowledge of Nature; the very reason it led to the development of technologies. But the profound discovery of Maxwell that light is the resolution of the contradiction of the electric and the magnetic forces; and specially his demonstration that light propagates as a wave; seemingly with a constant velocity c ; "has plunged the conscientiously thoughtful physicist into the greatest intellectual difficulties?", as Albert Einstein [19] put it; for causality-based physics.

The recognition of the quantum phenomena, its strange, uncertain and spooky nature, at the turn of the 20th century; brought complete disaster to otherwise certain, deterministic, causality abiding physics of the last few centuries and ironically at a time when physicists were ready to declare their domain of knowledge as complete! The discovery of this never-before observed or even dreamt of phenomena was so devastating that Einstein [22] expressed his despair in the following way, "Many physicists maintain - and there are weighty arguments in their favour - that in the face of these facts (quantum mechanical), not merely the differential law, but the law of causation itself - hitherto the ultimate basic postulate of all natural science - has collapsed".

The "spooky photon quanta", the greatest discovery of Einstein, ironically turned into his greatest enemy for his life-long efforts to deny its reality. Einstein led the physicists of early 20th century in denying quantum uncertainty in Nature, by developing ideal mathematics-based tools and theories of modern physics and cosmology, denying the existence of discrete elementary and point matter particles and even momentum; describing them as static and temporary wavelets or globules of continuous fields. These efforts still continue in modern official science, leading to unphysical and fantastic objects and phenomena in the realms of cosmology and even in terrestrial Nature. Century-long endless and meaningless scholastic discourse continuing since Einstein is the only outcome of the vigorous efforts and attempts to deny the "evil quanta", even though the quantum phenomena like electromagnetism have led to unprecedented development of modern technology. Ironically, theoretical physics and cosmology now face the darkest period of their history in terms of positive knowledge!

Long known constancy of the velocity of light c in Maxwell's equation, suddenly became of great importance and the sole weapon to fight the "evil quanta". Einstein promoted the ordinary fact of the constant c in Maxwell's equation to an axiom of absolute and geometrical truth, to develop and fabricate brain-cooked tools of Lorentz Transform, which this author has shown [23] to be totally brain-cooked, with no basis in objective reality. Einstein transformed Newtonian physics to relativistic physics, using these false abstract notion and "thought experiments" and Kantian subjective

idealism. Light, a special form of ordinary matter was raised to an esoteric divine status to fabricate the theories of relativity by Einstein [19,24-26]; which offered no positive knowledge but only led to unphysical objects and processes in the realm of cosmology. The transformation of Newtonian physics to relativistic physics did not solve the problems created by the “Evil Quanta”; on the contrary, it led physics to the cul-de-sac; where physicists are groping in the darkness or engaged in endless scholastic debates for more than a century and still counting. It can now be shown that Einstein’s theories of relativity (both Special and General) are nothing but abstract mathematical constructs and have no basis in objective reality [3,8,23,27].

The use of “rest mass”, m_0 given by $m = \gamma \times m_0$ (even for the ridiculous case when $m_0 = 0$ for photons), an impossible notion for dialectics and the wrong expression “ mv ” for momentum in Einsteinian electrodynamics have not only given rise to enormous confusion, mysteries and paradoxes involving the mysteries of “hidden momentum”; which in fact is the representation of Leibniz’s vis viva and the momentum “ mv^2 ”. Unsurprisingly, the hidden momentum or the hidden mechanical momentum is the mechanical momentum (mass x velocity) that is unaccounted for by Newtonian mechanics. The concept of mysterious “hidden momentum” has been used in answering “paradoxes” in Maxwell’s equations and other problems, including the Shockley–James paradox [28], and the Mansuripur paradox [29].

It must be mentioned here, that long before Maxwell’s and Einstein’s electrodynamics, the resulting confusion and paradoxes arising because of the lack of the understanding of momentum of the photons; Kepler already proposed momentum and vis viva for light photons. Kepler sought to explain the tail of a comet with the following proposition: “A comet’s tail is formed by matter that the Sun’s rays chase through their impulses outside the comet’s body” [30].

Quantum Electrodynamics:

As was discussed above, the discovery of the quantum phenomena was a total disaster, unresolvable puzzle and a source of enormous confusion for otherwise confident causality-based physics at the turn of the 20th century. The reason is that the quantum phenomena and more importantly, the discovery of the strange antiparticles; not only intensified the controversy of wave/particle duality in electrodynamics; it brought into focus the question of the ontological origin of matter and motion (i.e. momentum) – the fundamental attribute of any material/physical existence; for the first time in human history. Pre-quantum physics never even considered the ontological issue of the origin of the world, as like theology, it was taken for granted that everything is a creation of God. “The heavens declare the glory of God; And the firmament showeth his handiwork” ([Psalm 19:1 KJV](#)). Hence the role of physics was supposed to be to discover this Handiworks in the details of Nature. Even now, after the recognition of the quantum phenomena, the so-called “Big Bang” creation by God of a finite universe in the finite past is a major theory of modern physics. The ontology of matter, motion and the universe remain a perpetual mystery for physics even today!

As discussed above and in Ref.[3]; only Hegel, through the extension of his dialectical philosophy and in a very obscure and highly speculative way; but as the most brilliant scientific idea proposed the possible origin of matter and motion or momentum. But what good could come out of the verbosity of philosophy, which is “as useful to the physicists as ornithology is to the birds” according to Richard Feynman a prominent theoretical physicist! Hegel’s “portentous” speculation of the origin of momentum still remains an obscurity.

Meanwhile, for the “physicists” and in their fight against the “Evil Quanta”; matter has become a myth and so is momentum. For them, starting with Einstein; only “continuous fields” exists, because their brain-cooked ideal mathematics is incapable of dealing with discrete particles, discontinuity, uncertainty etc., implied by the Quantum phenomena and also with infinity. For Einstein, “Since the theory of general relativity (GR) implies the representation of physical reality by a continuous field, the concept of particles and material points cannot play a fundamental part and neither can the concept of motion. The particle can only appear as a limited region in space in which the field strength or energy density is particularly high”. Einstein, A. On the General Theory of Relativity, in David Levy (Ed.). The Scientific American Book of the Cosmos, N.Y., 2000, pp. 13.

Since Einstein, all kinds of ideal mathematics driven fantasies with arbitrary and fanciful mathematical tricks and concepts, like the Lorentz transforms (discussed above), “renormalization”, “spontaneous symmetry breaking”, “asymptotic freedom” etc., has given rise to all kinds of theories the collective name of which is now known as the “Standard Model”, but as in the case of the theories of relativity of Einstein, all these fantasies about the quantum phenomena, have provided no positive knowledge. The validity and justification of these esoteric theories comes only through subjective, contrived, deceptive and even outright false “experimental proofs”. The field-based and ideal mathematics driven fantasy has led official theoretical physics and cosmology to an impasse; with no hope of even coming out of this dead end. Einstein, by the end of his life came to admit this failure: “All these fifty years of conscious brooding have brought me no nearer to the answer to the question, ‘What are light quanta?’ Nowadays every Tom, Dick

and Harry thinks he knows it, but he is mistaken... I consider it quite possible that physics cannot be based on the field concept, i.e., on continuous structures. In that case, nothing remains of my entire castle in the air, gravitation theory included, [and of] the rest of modern physics": Albert Einstein, quoted by A Pais,": Albert Einstein, quoted by A Pais, 'Subtle is the Lord ...', *The Science and the Life of Albert Einstein*". Oxford University Press, (1982) 467

The only positive outcome for this century-long mathematical acrobatics and Armageddon came through Paul Dirac's quantum electrodynamics, which used a philosophical "product", namely imaginary number and the dialectical contradiction of the combination of real and imaginary magnitudes and non-commutative algebra; all forbidden in ideal mathematics! In his attempt to develop a theoretical framework for describing spin 1/2 particles, Dirac thereby made a revolutionary discovery of hitherto unknown dialectical realm of the "unity of the opposites" of "matter-antimatter". To describe the spin 1/2 particles, Dirac found it necessary to incorporate imaginary and complex quantities in his equations that gave rise to the complex conjugate field ϕ^* of the real field ϕ , where the complex-conjugate fields ϕ^* can accommodate the antiparticles. This is a new aspect of reality brought forth by the developments in quantum physics. Classical physics previously only dealt with integral spins of 0, 1 and 2 in its equations namely, the Klein-Gordon, Maxwell (electromagnetism) and Einstein (general relativity) equations, respectively; which readily accommodate only real fields.

The concept of antiparticles in nature means that, as a dialectical necessity all particles must have or be their own antiparticles. This "unity of the opposites" may manifest either in the same body like the two poles of a magnet or on separate bodies like the positive and negative electric charge or in the same body simultaneously as matter-antimatter in Majorana particles [31], containing the opposites continuously exchanging into their opposite polarity; depending on the nature of the exchange force that keep the two opposites together and the external circumstances under which this force operates.

Dirac's quantum electrodynamics led to the recognition of the quantum vacuum and the notion of virtual particle-antiparticle pairs momentarily coming in and going out of existence, exactly what Hegel anticipated as the contradiction "Being-Nothing" in his philosophy of space and time [3,8]. The quantum phenomena therefore, is a direct representation of Hegelian dialectics and settles the ontological question of the origin of momentum and material/physical existence from the quantum to the cosmic realms. The virtual particles of the quantum vacuum can become real particle, by a well-known process of quantum tunnelling or when enough energy to compensate for their momentum is available from any source. The photons of classical electrodynamics follow the same quantum rule like any other quantum particles. The only difference is that as uncharged particles, the photons only exist in their free elementary and never is any aggregated compound structure like other quantum particle such as electrons, protons etc., which can form larger aggregated structures like atoms and molecules, where their momentum is determined by an averaging of the external forces in the aggregates. As stated above, light photons usually exist in their virtual state either in the quantum vacuum or bound up in atoms and molecules. The photons in free state are instantly created from their virtual state with a momentum " mv^3 " [8,9, 23,27] and exist in free state until absorbed in either by another atom or molecule or vanishes back to the quantum vacuum as virtual particles. All other matter particles in their compound state have the momentum " mv^2 " in their in their absolute dynamics as posited by Leibniz's vis viva and mediated by the gravitational potential [7] of their particular existence.

The dialectical view of the quantum phenomena and the virtual particles of the quantum vacuum not only solves the ontological question of the momentum, but also resolves other long-running issues of wave/particle duality, matter/antimatter paradox, the Majorana particles and most importantly the question of the uncertainty principle. The development of quantum dialectics [8] and the recognition of the virtual particles of the quantum vacuum [3,32], clearly demonstrate that the uncertainty principle discovered by W. Heisenberg [33], is not just a simple measurement or statistical problem of permanently existing particles like photons and electrons in Nature created by God in a "First Impulse"; as is commonly assumed. Uncertainty and the breakdown of the conservation laws at the substructure of quantum level is a fundamental aspect of objective reality [3, 32,34].

The uncertainty principle (and the related quantum phenomena) is not the only paradox arising from assumed conservation laws, in quantum physics. The conservation laws lead to other paradoxes like the Aharonov-Casher effect; is a quantum mechanical phenomenon predicted in 1984 by Y. Aharonov and A. Casher [35] in which a traveling magnetic dipole is affected by an electric field. The conservation laws at macroscopic (human) scale the objective reality is just a reflection of a gross, averaged-out, summed-up and apparently stable superstructure of micro-level quantum uncertainty. Physics needs a revolutionary change of its epistemology - from traditional causality to dialectical materialism; to deal with this new revolutionary aspect of objective reality! The wave/particle duality of light and other quantum particles now have a rational explanation based on real/virtual exchange as proposed in the following

publication by this author [32]. This invalidates the Nobel Awarded, fantastic and unreal phenomena and arbitrary mathematical tricks of “renormalization”, “path-integrals” [36] etc., fantastic explanations of official physics.

Conclusions:

It is clear from the works presented above, that the formulation of momentum as “ mv ” by Galileo was at odd with his inverse square law of gravity in terrestrial Nature. But its forceful use in the subsequent developments in physics in opposition to the correct formulation “ mv^2 ” of Leibniz and Kepler’s absolute dynamics, since Descartes and Newton until now has given rise to the present crisis, particularly in theoretical physics and cosmology.

It seems safe to assume that the developments in physics, particularly after Newton, was consciously or unconsciously (or a combination of both), manipulated by some powerful subjective forces, at the behest of the established order and theology; the way Emmanuel Kant did in philosophy, who “found it necessary to make room for faith”! This conflict represented a clash between falsity and objective truth; idealism and materialism; theology and science; the world views of Causality and Dialectics; going back to early Greek philosophy of Parmenides-Plato on one side and Heraclitus-Epicurus on the other.

The recognition of the quantum phenomena at the turn of the 20th century, overwhelmingly favorable to the world-view of Dialectics, personified by Hegel; has intensified the usual historical contradiction between the unyielding old and the overwhelming new of the present epoch!

References

- Engels, F (1883), “Dialectics of Nature”, Ed. By J.B.S. Haldane; International Publishers (N.Y.), p56-58
- d’Alembert, Jean-Baptiste le Rond (1748), “Traité de dynamique” (2nd ed.). Gabay (1990 reprint).
- Malek, A., (2016), “The Philosophy of Space-Time: Whence Cometh Matter and Motion”? JOURNAL OF ADVANCES IN PHYSICS, 12(2), 4270–4277. <https://doi.org/10.24297/jap.v12i2.163>
- Malek, A., (2003), “The Cosmic Gamma-Ray Halo – New Imperative for a Dialectical Perspective of the Universe”, Apeiron, Vol. 10, No. 2, <http://redshift.vif.com/JournalFiles/V10NO2PDF/V10N2MAL.pdf>
- Malek, A. (2005), "Ambartsumian, Arp and the Breeding Galaxies", Apeiron, Vol. 12, No. 2, April 2005 <http://redshift.vif.com/JournalFiles/V12NO2PDF/V12N2MAL.pdf>
- Hegel, G.W.F. (1830) “Encyclopaedia of the Philosophical Sciences”, Philosophy of Nature, II Inorganic, § 208, source <https://www.marxists.org/reference/archive/hegel/works/na/nature2.htm>
- Malek, A. (2021), “KEPLER – NEWTON – LEIBNIZ – HEGEL : Portentous And Conflicting Legacies In Theoretical Physics, Cosmology And In Ruling Ideas”, J. Adv. Phys., 19, 221–232. <https://doi.org/10.24297/jap.v19i.9106>
- Malek, A. (2024). New Physics – “The Negation of Einstein’s Theories of Relativity”, J. Adv. Phys. 22, 54–61. <https://doi.org/10.24297/jap.v22i.9594>
- Malek A (2024), “WHAT IS LIGHT, REALLY? A QUANTUM DIALECTICAL VIEW”, Ann. Math Phys., 7(3), 292-299. <https://www.mathematicsgroup.us/articles/AMP-7-235.pdf>
- Hegel, G.W.F (1830) Ref. 6, § 212.
- Hegel, G.W.F (1830) Ref. 6, § 214.
- Hegel, G.W.F. (1830), Ref. 6, § 210., and § 211.
- Quoted by, T. Posch, “Hegel’s Criticism of Newton’s Physics: A Reconsideration“, Oxford Conference on “Hegel and British Thought“, 2nd-3rd Sept. (2004). <https://core.ac.uk/download/pdf/12236749.p>
- Hegel, G.W.F., Encyclopaedia of the Philosophical Sciences, source; “Logic”. §98, Trans. William Wallace (2014), The Clarendon Press, Oxford,. [https://www.marxists.org/reference/archive/hegel/works/na/nature.htm\(a\)](https://www.marxists.org/reference/archive/hegel/works/na/nature.htm(a))
- Engels, F (1883), Ref. 1, p327
- Hegel, G.W.F. “The Phenomenology of Mind”, PREFACE: “On scientific knowledge” Trans. Walter Kaufmann’s Hegel: Texts and Commentary (Doubleday 1965). [Φ 43. https://www.marxists.org/reference/archive/hegel/works/ph/phprefac.htm](https://www.marxists.org/reference/archive/hegel/works/ph/phprefac.htm)
- Malek, A. (2017). THE CONCEPTUAL DEFECT OF THE LAW OF UNIVERSAL GRAVITATION OR FREE FALL: A DIALECTICAL REASSESSMENT OF KEPLER’S LAWS: J. Adv. Phys.,13(5), 4876–4880. <https://doi.org/10.24297/jap.v13i5.6131>
- Malek A (2023) Quō Vādis theoretical physics and cosmology? from Newton’s Metaphysics to Einstein’s Theology. Ann Math Phys 6(1): 065-070. DOI: [10.17352/amp.000081](https://doi.org/10.17352/amp.000081)
- Einstein, A., (1920), "Relativity, The Special and General Theory", Methuen & Co Ltd. (Three Rivers Press, New York, 1961), <https://www.bartleby.com/173/7.html>
- Tegmark, M., (2014) Our Mathematical Universe: My Quest for the Ultimate Nature of Reality, Knopf Pub.

21. Maxwell, J. C., (1865). "[A dynamical theory of the electromagnetic field](#)" (PDF). Philosophical Transactions of the Royal Society of London. 155: 459–512. [Bibcode:1865RSPT..155..459M](#). [doi:10.1098/rstl.1865.0008.S2CID.186207827](#)
22. Einstein, A. (1934), "Essays in Science", p. 38-39 (1934).
23. Malek, A. (2021) "The Mystery of the Lorentz Transform: A Reconstruction and Its Implications for Einstein's Theories of Relativity and cosmology", J. Adv. Phys. 19, 174-184, INSPIRE>HEP: <https://inspirehep.net/literature/2158754>
24. Einstein, A., "Zur Elektrodynamik bewegter Körper", (1905) Annalen der Physik 17: 891; English translation "On the Electrodynamics of Moving Bodies" by Megh Nad Saha (1920). [https://en.wikisource.org/wiki/On_the_Electrodynamics_of_Moving_Bodies_\(1920_edition\)](https://en.wikisource.org/wiki/On_the_Electrodynamics_of_Moving_Bodies_(1920_edition))
25. Einstein, A., (1905) "On a Heuristic Point of View Concerning the Production and Transformation of Light", Ann. der Physik, Vol. 17, pp132-148.
26. Einstein, A., (1915), "[Die Feldgleichungen der Gravitation](#)", Sitzungsberichte der Preussischen Akademie der Wissenschaften zu Berlin: 844–847 See also [English translation at Einstein Papers Project](#) <https://einsteinpapers.press.princeton.edu/vol6-trans/129>
27. Malek, A. (2024). "New Physics II – Quantum-Dialectical Derivation of New Mass-Energy Relation Invalidates Einstein's Famous Equation $E = mc^2$ ", J. Adv. Phys., 22, 178–184. <https://doi.org/10.24297/jap.v22i.9642>
28. Boyer, T. H., (7 January 2015). "Classical interaction of a magnet and a point charge: The Shockley-James paradox". Phys. Rev. E. 91 (1): 013201. [arXiv:1408.3742](https://arxiv.org/abs/1408.3742)
29. Mansuripur, M., (2014). "The Lorentz Force Law and its Connections to Hidden Momentum, the Einstein–Laub Force, and the Aharonov–Casher Effect". IEEE Transactions on Magnetics. 50 (4): 1–10. [arXiv:1404.3261](https://arxiv.org/abs/1404.3261). [Bibcode:2014ITM....5091817M](#)
30. Kepler, J., (1619) De cometis libelli tres. I. Astronomicus... II. Physicus... III. Astrologicus..., Augustae Vindelicorum, Augsburg; translation by H. Flaugergues in the Journal de physique, de chimie et d'histoire naturelle, vol. LXXXV, September 1817, p. 193-216.
31. Malek, A (2015). "Majorana Particles: A Dialectical Necessity and not a Quantum Oddity", PROGRESS IN PHYSICS, Volume 11, Issue 1 (January). <https://progress-in-physics.com/complete/PIP-vol-11-%282015%29.pdf>
32. Malek, A. (2014), "The Real/Virtual Exchange of Quantum Particles as a Basis for the Resolution of Wave-Particle Duality and Other Anomalies of the Quantum Phenomena", PROGRESS IN PHYSICS, Volume 10, Issue 4 (October): <https://progress-in-physics.com/2014/PP-39-03.PDF>
33. Heisenberg, W. (1927). "[Über den anschaulichen Inhalt der quantentheoretischen Kinematik und Mechanik](#)". Zeitschrift für Physik (in German). 43 (3): 172–198. [Bibcode:1927ZPhy...43..172H](#)
34. Erhart, J., et al., Experimental demonstration of a universally valid error-dist. <https://www.nature.com/articles/nphys2194>
35. Aharonov, Y. and Casher, A., (1984). "[Topological quantum effects for neutral particles](#)". Phys. Rev. Lett. 53 (4): 319–321. [Bibcode:1984PhRvL..53..319A](#)
36. Feynman R.P., Hibbs A.R., and Styer D.F. (1965), "Quantum Mechanics and Path Integrals". Dover Publications, Mineola, N.Y., pp. 29–31 Acknowledgement: The author declares no conflict of interest.