

**KEPLER – NEWTON – LEIBNIZ – HEGEL**  
**Portentous and Conflicting Legacies in Theoretical Physics, Cosmology**  
**and in Ruling Ideas**

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**ABSTRACT**

Kepler's Laws of planetary motion (following the Copernican revolution in cosmology), according to Leibniz and his follower Hegel, for the first-time in history discovered the keys to what Hegel called the *absolute mechanics* mediated by dialectical laws, which drives the celestial bodies, in opposition to *finite mechanics* in terrestrial Nature developed by mathematical and empirical sciences, but that are of very limited scope. Newton wrongly extended and imposed finite mechanics on the *absolute mechanics* of the cosmic bodies in the form of his Law of one-sided Universal Gravitational Attraction, by distorting and misrepresenting Kepler's profound laws and in opposition to Leibniz's more appropriate "*Radial Planetary Orbital Equation*". The still-prevailing error by Newton, not only shows the limitation of mathematical idealism and prejudice driven modern cosmology in the form of Einstein's theories of relativity; but also, have made gaining positive knowledge of the cosmos an impossibility. It has impaired social/historical development of humanity by reinforcing old and decadent ruling ideas. Hegel's Naturphilosophie is not only a protest against the misrepresentation of Kepler's Laws in particular; his *Enzyklopädie der Philosophischen Wissenschaften* is the negation and the direct rebuttal of Newtonian physics and *Philosophiæ Naturalis Principia Mathematica*, in general. Modern natural science ignores Leibniz and Hegel at its own peril! Kepler's phenomenological laws of planetary motion and the dialectical insights of Leibniz and Hegel opens the way for gaining positive knowledge of the dynamics, structure and the evolution of the cosmic bodies and other cosmic phenomena; without invoking mysteries and dark/black cosmic entities, which has been the pabulum of official astrophysics and cosmology so far.

**Introduction: *Quō Vādīs* Theoretical Physics and Cosmology? From Newtonian Wrong Turn to Einsteinian Mathematical Wonderland!**

*"At first sight, what we seem to have here [i.e. in the relation between the works of Hegel and Newton A.M.] is little more than the contrast between the tested accomplishments of the founding father of modern science, and the random remarks of a confused and somewhat disgruntled philosopher; and if we are persuaded to concede that it may perhaps be something more than this – between the work of a clear-sighted mathematician and experimentalist, and the blind assertions of some sort of Kantian logician, blundering about among the facts of the real world".* Michael Petry [1], one of the prominent interpreters of Hegel's philosophy wrote these sentences as recently as in 1993. This reflects the general attitude towards the relationship between Newton's and Hegel's work that prevails among physicists in particular and philosophers in general. So, one can easily guess that reaction to any favourable reference to Hegel in relation to physics or Newton, would not be any better, to say the least! But a truth [2] is worth telling millions of times!

Johannes Kepler's laws of the planetary motion in the solar system came following the exquisite observations (without even a telescope) by Tycho Brahe; at the advent of Copernican revolution in cosmology against Ptolemaic Epicycles that had formed the ruling idea of medieval feudal Europe until that time. The great upheaval that followed led to one of history's greatest social and scientific revolution propelled by the scientific works of Galileo, Kepler et al., among others; culminating in Newtonian mechanics. But in the euphoria of

brehtaking social, scientific and technological revolution that followed; what was forgotten, according to G.W.F. Hegel (who inherited and perfected Leibniz's and Kant's dialectics), is one vital point that Newton's crass mechanistic and mathematical approach to natural science apparently successful in terrestrial Nature; was like a poison pill that was destined to undo the Copernican revolution itself! In particular, Newton's unlimited and one-sided extension and transference of his dynamical laws developed in terrestrial Nature (and the related mathematization of physics); to the realm of the cosmos in the form of his law of universal gravitational attraction; even if unwittingly, distorted and undermined Kepler's profound phenomenological laws of the heavens; and thereby clouded the vision of the cosmos.

The misrepresentation of Kepler's profound discovery not only did grievous harm to the Copernican/Galilean revolution against the ruling metaphysics, theology and the God of feudalism; but eventually led to the latter's reinforcement in the form of Einsteinian cosmology based on general relativity; with the transition of bourgeois capitalism to Anglo-American led world monopoly capitalism by the turn of the 20<sup>th</sup> century. The Newtonian mathematization of physics and cosmology was put on steroids in the hands of Albert Einstein and by now physics all but has become extinct. A modified Ptolemaic cosmology and the idea of God has once again been turned into the ruling idea by monopoly capitalism. Einsteinian cosmology more strongly solidified the age-old general outlook, in which the central point is the view of the absolute immutability of Nature. In whatever way Nature came into existence, it remained the same. The universe and the cosmic bodies once set in motion by the mysterious "first impulse" now known as the "Big Bang", kept on moving in their predestined orbits in an ever-expanding (?) universe. Ironically, all these came as a reaction to the radical developments in biology in the form of Darwin's theory of evolution of the species and more importantly to one of history's most revolutionary developments in physics, namely quantum physics that unveiled an aspect of objective reality that was totally unknown or even unthought of before; but only very dimly anticipated by Hegel's dialectics [3,4].

But resistance to this fate of physics and cosmology came in the form of the conflict in epistemology between British Empiricism with Newton at its epitome and the German philosophy of G.W. Leibniz, Immanuel Kant and G.W.F. Hegel. Leibniz's better formulation of planetary motion, Kant's revolutionary Nebular Hypothesis of the cosmos and the brilliant dialectical method of Hegel as points of departure for cosmology, remain without any consequence till today. Based on the discovery of Kepler, Leibniz [5 a,b] for the first time gave the more appropriate "*Radial Orbital Equation*" of planetary motion of the solar system in terms of the contradiction of centrifugal and centripetal forces. But the authoritative ruling by "*Commercium Epistolicum*" of The Royal Society silenced Leibniz forever; not only Leibniz's claim of priority as the inventor of calculus but also his more appropriate [5,a] "*Radial Orbital Equation*" that had the potential to correct Newton's mistake concerning the Law of Universal Gravitational Attraction - a mistake that has impeded understanding of the cosmos, the universe and objective reality. Kant's Nebular Hypothesis was a point of departure for physics and cosmology. This hypothesis for the first time in the history of natural science, pointed to the fact that things and processes in Nature are not given at one stroke and "perfect in themselves" as was thought before, but "*comes into being*" and evolve in the course of time. That Nature and the cosmic bodies not only have existence and extension in space, but also have a history of evolution in time.

But this revolutionary and dialectical world view like Leibniz's work on planetary motion had no chance of seeing the daylight and remained without any consequence. The prevailing and (social) class-friendly static world view of Aristotelian formal logic, British empiricism and "good old common-sense" of everyday life experience (that came as the natural evolutionary legacy of man), which Hegel collectively termed as "*the view of understanding*" and popularly known as causality and personified by Newtonian mechanics was too strong and reactionary a social force to allow Leibniz's work to have any positive impact. Leibniz's conflict with Newton was not confined to the issues involving calculus and the interpretation of Kepler's Laws; it entailed a difference in world view of which philosophy and physics were the primary elements. It was not only physics that languished within the confines of British empiricism – practical, useful for ordinary life, but inherently impotent as a tool for positive knowledge of Nature; philosophy in the form of Kantian subjective idealism was even more so. Kant, following David Hume, declared that objective reality is an "unknowable thing-in-itself" and warned philosophy to abate its claim to any knowledge of the world beyond sense perception.

Hegel took the life-long challenge to rectify this world view itself, which he termed as "the view of understanding", that gave rise to the low point for philosophy; physics and cosmology represented by Kant and Newton respectively. Hegel's THE ENCYCLOPAEDIA OF THE PHILOSOPHICAL SCIENCES IN OUTLINE [6,a,b,c] is the outcome of his successful long-term enterprise; but as the title speak out loudly, it is only an outline, a scaffold or a skeleton that has to be brought to its full richness and grandeur by his posterity. But Hegel gave it enough of an impetus to get a vibrant life of its own. Hegel accomplished this task by embracing the very same elements, namely the ideas of evolution and contradictions etc., which the "view of understanding" abhorred the most. On the contrary, he put them at the very heart of his new philosophical system – the dialectical method. Hegel unambiguously rejected the law of *non-contradiction* of theology, old idealism, rationalism and classical materialism; the "*excluded middle*" of Aristotle and the *thing-in-itself* of Kant. For Hegel, absolutely everything consists of "*the Identity of identity and non-identity.*" Opposites reside together in the very element of a thing or a process in simultaneous unity and opposition to each other and a resolution of this logical contradiction and conflict provides the dynamics for change, motion, evolution, development etc. For Hegel, there is no absolute *being* or absolute *nothing* by themselves, they always implicitly contain each other and hence one can issue out of the other without the necessity of any act of creation and without breaking the rules of formal logic. Hegel performed this miracle, which the "view of understanding" was unable to do without resorting to the intervention

from Providence or God; ironically, without the breach of the fallacy of illicit process or the principle: *ex nihilo nihil fit* of formal logic; which forbids the derivation of a conclusion that is not present in the premise or a consequent not contained in the antecedent.

From an encyclopedic comprehension of the history of man and Nature, Hegel developed his “speculative” philosophy [6] and the revolutionary dialectical method for epistemology by incorporating the ideas of Heraclitus and the later development of dialectics by other thinkers of history from Epicurus to Kant. Hegel called his philosophy “speculative” or “the view of reason”, to distinguish it from the traditional and merely mechanical philosophy or “the view of understanding”, intensified through Newtonian natural science. Hegel, for the first time in the history of thought, united the perennial division between idealism and materialism or the separation of the “ideal” and the real” into one of a dialectical contradiction of the “unity of the opposites” – a contradiction that is at the root of all change, motion, evolution, development etc., in the manifestation of the universe; as a never-ending process. In this view, any existence at all, is a process in contradiction; eternally resolving through “the negation of the negation”, quantitative change giving rise to qualitative leap and vice versa. This higher synthesis of Hegel conceives the universe as infinite, eternal and an ever-changing organic being and an integrated whole, self-evolving due to inner contradiction and mediated by chance and necessity, without any outside intervention. This view is in direct opposition to “the view of understanding” that posits a finite universe and all its contents created in the finite past, “perfect in themselves”. The latter view confines itself to knowledge limited to sense perception, reduces the whole to the sum of its parts, loses its way in the minor details of complexity in an orgy of crude empiricism, mechanism and determinism and refuses the role of dialectical chance and necessity from playing its essential role both in the manifestation of Nature and its reflection in man’s cognitive thought. The “view of understanding” (*Verstandeserkenntnis*) for Hegel, is essentially conservative in its outlook, unnecessarily creates an artificial gulf between the Ideal and the Real, Thought and Matter, Spirit and Nature and then requires an arbitrary mysterious power/force from outside to bridge the gaps.

Hegel thus posited his dialectics at the very core of reality and ontology itself. Everything in the universe, therefore, implicitly contains everything else and evolve in stages, through discrete leaps of “the negation of the negation” in the chain of the resolution of the contradictions; mediated by blind chance and an iron necessity that is inherent in chance. The role of any worthy epistemology is to subjectively grasp and comprehend this objective dialectical process occurring in the manifestation of the universe, Nature, Life, Society and Thought. Hegel’s dialectics therefore is capable of perceiving the evolution of the universe from the quantum microcosm to the macrocosm of the galaxies and their clusters, of organic life, man and his thought as an interconnected whole in a hierarchical order that provide necessity and universality for everything that was lacking in pre-Hegelian epistemology [6]. Hegel’s dialectics is therefore not only a negation and a protest against the old and prevailing system of thought and against the rehabilitation of it through Kantian subjective idealism; it is a revolutionary act of departure from hitherto all old epistemology of the world. Hegel’s epistemology, like that of Heraclitus, is inimical to any dominating established order and all class-based and fixed social formation.

### **Contradictions and the Dialectical Method:**

It is beyond the scope of this article to discuss about Hegel’s dialectical method, but some understanding of it is essential to appreciate his position on Kepler’s laws and planetary dynamics vis-à-vis that of Newton. The word “contradiction” is unholy and unintuitive for the sensibility of formal logic, but it is a gem and the very soul of the dialectical method! The lack of a clear distinction of this fact and the misunderstanding of dialectical contradictions is at the root of the crudest, the most banal and spurious opinion of Hegel’s philosophy and science. As Hegel [6a, § 956] says, *“But it is one of the fundamental prejudices of logic as hitherto understood and of ordinary thinking that contradiction is not so characteristically essential and immanent a determination as identity; but in fact, if it were a question of grading the two determinations and they had to be kept separate, then contradiction would have to be taken as the profounder determination and more characteristic of essence. For, as against contradiction, identity is merely the determination of the simple immediate, of dead being; but contradiction is the root of all movement and vitality; it is only in so far as something has a contradiction within it that it moves, has an urge and activity”*. Dialectical thought is unintuitive to ordinary reflection, specially to formally trained scientists who are totally engrossed and conformed to formal logic and take a mechanical, deterministic and reductionist mathematical approach to physical phenomena. Dialectical thought needs deep reflection, introspection and retrospection - it can be termed as the thought of thoughts.

As discussed above, for Hegel, contradictions lie at the very fundamental level of ontology and objective reality; the spontaneous and successive resolution of the contradictions form the dynamics for the manifestation of the material universe [3,4]. The contradiction of abstract and infinite space and time resolves to the “virtual particles” of the quantum reality; the contradiction of the real and virtual resolves to the formation of matter/antimatter particles in “free motion” and so on. New fundamental matter and antimatter particles are spontaneously created from the quantum virtual particles, preferably at the core of the galaxies leading to their extension and proliferation as a dialectical process; mediated by chance and necessity. In this view the galaxies and other cosmic bodies grow and proliferate from within; rather than through the universal and one-directional condensation of diffuse matter created from a single event in the past, such as the Big Bang. Material bodies are endowed with the contradiction of the unity of the opposites of “absolute free motion” expressed as repulsion (the tendency to “fly away” from itself), and attraction (the tendency of “free fall”) mediated by dialectical chance and necessity. Gravity is the “moment” of these two opposite tendencies. Hegel distinguishes the finite or ordinary

mechanics of “dead” or “selfless bodies” on the surface of the earth (or of any large cosmic body), whose absolute motion is suppressed by earth’s dominant and one-sided gravitational attraction that Newton was concerned with; from the “absolute free motion” of the cosmic bodies in any group formation like the solar system, where the contradiction is active. So, Hegel’s criticism of Newtonian physics and cosmology (– the subject matter of this article), or anything else of pre-Hegelian scholasticism, must be seen from his overall dialectical world outlook. But lest anyone doubts his competence and the veracity of his science, Hegel gave a pre-warning in a letter to the rationalist theologian Paulus, in 1843, he wrote [7]: “*You know that I have had too much to do not merely with ancient literature, but even with mathematics, latterly with the higher analysis, differential calculus, chemistry, to let myself be taken in by the humbug of Naturphilosophie, philosophising without knowledge of fact and by mere force of imagination, and treating mere fancies, even imbecile fancies, as Ideas*”. In an exclusive article on “Hegel and the Philosophy of Physics”, J.N. Findlay [8] writes, “*There is no case in Hegel where a philosophical interpretation of Nature is not scientifically documented*”.

Hegel, sided with Leibniz view in opposition to that of Newton’s interpretation of Kepler’s Laws. Hegel in a more concrete, profound and systematic way vehemently objected to this misrepresentation by Newton of Kepler’s Laws in particular and the mis-redirection of Newtonian orientation of physics and cosmology in general; towards what Hegel called the un-reflected “view of understanding” as opposed to “the view of reason” or dialectics; a distinction between un-reflected “thinking” (“denkende”) and “comprehending consideration” of Nature (“begreifende Naturbetrachtung”). But the British domination of the world as a colonial power and later emergence of Anglo-American-led world monopoly capitalism since the turn of the 20<sup>th</sup> century made it certain that Newtonian physics and British empiricism reign supreme in natural science; while on the contrary, each major development like the quantum phenomena, only pushed theoretical physics further into the domain of metaphysics, mathematical idealism and theology. Hegel was not only forgotten by the ensuing developments in physics but became a subject of much ridicule, abuse and enmity by modern official theoretical physicists and philosophers [1].

Meanwhile, by bringing the Newtonian programme of mathematization of physics to its logical conclusion, i.e., to its epitome of a metaphysics, (which ironically Newton warned against!), by the turn of 20<sup>th</sup> century, Albert Einstein with his much venerated theories of relativity unwittingly and in a dialectical sense, brought an end of physics itself and along with it the credibility of the ruling ideas of monopoly capitalism. For Hegelian dialectics, any truth when extended beyond certain limit either turns to its opposite or becomes an absurdity. The situation has become so acute that the credibility of the mathematical idealism based esoteric theories of modern official theoretical physics can only be artificially maintained through multi-billion dollar subjective, contrived and deceptive “experimental proofs”; achieved through the lure of fame, fortune and funds. But Darwin’s theory of biological evolution and particularly the discovery of the quantum phenomena is the decisive and final act through which physics gets its rebirth from the ashes of mathematical idealism that started with Newton and thereby brings a vindication of Hegel’s “view of reason” or dialectics.

There is little wonder that it is not official physics, but official philosophy with its non-mathematical “verbose” finds renewed interest in Hegel, not only for his criticism of Newton’s epoch-making mistake of mis-representing Kepler’s revolutionary Laws of the heavens, but also in Hegel’s philosophy in general; and ironically in the land where Hegel was hated the most, namely England. “*The Puzzling Hegel Renaissance,*” [9] since the publication of *The Cambridge Companion to Hegel* in 1993, is that there has been a notable growth of interest in Hegel and a vast increase in the quantity of scholarly work on his philosophy. But this philosophical interest [9, 10, 11] in Hegel’s works is forced on modern epistemology by the sheer revolutionary nature of Hegel’s Naturphilosophie on the one hand and the bankruptcy of official theoretical physics and cosmology on the other; brought on by Einsteinian mathematical idealism – an outcome that Hegel foresaw and warned against. The “*Hegel Renaissance*”, however, is not motivated to recognize the profound nature of Hegelian science; but to undermine it and to use it as an apology to re-invigorate and reinforce Newtonian metaphysics in the form of Einsteinian metaphysics in natural science. This renewed interest in Hegel according to Paulucci [11] one of such apologists, is only “*to review Hegel’s criticism of Newton’s ‘system of the world’ and then to examine critically the many aspects of it that seem to anticipate the approach to mathematical physics, which is today associated with the name of Einstein*”. This lame excuse is the exact opposite of the essence of what Hegel’s criticism was meant to be. This shallow view from the representatives of official and academic philosophy comes from a total lack of understanding of dialectical mode of thought. To be fair, it must be recognized that there are some exceptions among modern philosophical works [12] on Hegel’s Naturphilosophie, which are more sympathetic or at least more understanding of Hegel’s severe criticism of Newton’s vulgarization of the Keplerian view of the planetary system. But whatever the case may be, this reluctant revival of intense interest in Hegel’s work on Naturphilosophie, reflects its fundamental importance in modern theoretical physics and cosmology; on the one hand due to the bankruptcy of Einsteinian mathematical idealism and on the other, because of the discovery of the quantum phenomena that Hegel’ dialectics anticipated [3]. The recent warning “*Scientific method: Defend the integrity of physics*” from some notable physicists/cosmologists [13] against this danger of mathematical idealism to physics is therefore a wake-up call for all physicists.

In Naturphilosophie at least, Hegel is an early Marx, not “standing on his head” but on his two feet, in a combatting mood to undo Newtonian metaphysics in natural science and replace it with his revolutionary dialectical approach, that would banish all forms of metaphysics, mysticism from natural science. Hegelian ontology of space, time and objective reality was much ahead in time and his triad “*being-nothing-becoming*” dimly anticipated the quantum phenomena in Nature as recently interpreted by this author [3]. Even later

dialectical materialists including Marx, Engels and Lenin among the notables could not appreciate the revolutionary significance of Hegel's views on ontology (and cosmology); because on the one hand, natural science by their time did not progress far enough yet to put the questions of ontology in its agenda; and on the other hand, the breathtaking developments in science and technology looked as if Newtonian science is omnipotent. Vladimir I. Lenin lived on to see the early development of quantum physics; which was yet to reveal its ontological significance. Lenin fought against the positivist and anti-materialist orientation of physics brought on as a reaction against the revolutionary quantum phenomena of objective reality; but at the same time denounced Hegel's speculations on the ontological questions as blind idealism.

### **The Nature and the Significance of Hegel's Antagonism of Newtonian Physics:**

Hegel's criticism of Newton, his world view ("understanding") and physics was scathing, amounting to ethnic slur of British empiricism. Hegel compared Newton with Moliere's bourgeois *gentilhomme*, who like Monsieur Jourdain's "prose" seemed never to have realized *"that he thought in and had to deal with notions of the understanding, while he imagined he was dealing with physical facts"* [14]. Hegel rejected the Principia's 'proofs' of Kepler's laws - proofs which he characterized as *"demonstrational jugglery and counterfeiting"* [14]. That Hegel's severe criticism is well merited is recognized even by an adverse modern critic of Hegel, like Paulucci [14], *"One must emphasize that Hegel's criticism was well informed. Certainly, he knew the Philosophiae naturalis principia mathematica and Opticks first hand and had the requisite training in mathematics to comprehend what he read. Through hundreds of well-documented pages of his Science of Logic (large and small) and Philosophy of Nature, Hegel explores the meaning of Newton's fluxional calculus, his concepts of space, time, mass, inertia, centripetal and centrifugal forces, his laws of motion, his gravitational world-system, and, finally, his theory of light and colors. Particularly under the headings 'Quantity' and 'Measure' in the Logic and 'Mechanics' in the Philosophy of Nature, Newton's doctrine provides much of the empirical datum upon which the Hegelian philosophical dialectic operates"*.

The fact that an erudite modern thinker of Hegel's stature would risk his legacy with such strong stance against Newtonian physics at a time when it would seem like lunacy, speaks for the seriousness and the fundamental way Hegel differed with the epistemology of the established order represented by Newtonian natural science and on the contrary his confidence on the revolutionary nature of his dialectical science. But from Hegel's point of view (like that of Leibniz), it was a risk worth taking, in view of his conviction that Newtonian metaphysics and the mathematization of physics would impair further positive knowledge of the cosmos in particular and of natural science in general and that Newtonian metaphysics is a counter-revolution to undo the revolutionary developments brought on by Copernicus, Kepler and Galileo et al., and with the potential to revive blind faith of theology and the regressive ruling order of feudalism, undermining the democratic revolution in Europe. Hegel therefore, foresaw the rise of the impotent mathematical idealism of Einstein and a decadent ruling order under monopoly capitalism – the exact opposite outcome of the bourgeois democratic revolution which even as the official philosopher of the Prussian monarchy, Hegel had welcomed so enthusiastically! This explains the reason why Hegel made a challenge to Newtonian theoretical physics and cosmology the central issue of his philosophy and science in particular and a challenge to all pre-Hegelian epistemology and world view in general. Hegel tauntingly wrote [6a, §98] *"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"*. A cursory reading of Hegel's Encyclopedia of Philosophical Sciences [6] in its three parts, a) The Science of Logic (the short version), b) The Philosophy of Nature and c) The Philosophy of Mind/Spirit, would clearly show that Hegel took Newton as his principal adversary in the clash of his new revolutionary world outlook and considered himself as the principal inheritor of the scientific revolution brought forth by Copernicus, Kepler and Galileo. If *Philosophiæ Naturalis Principia Mathematica* is the magnum opus of Newton, then *Enzyklopädie der Philosophischen Wissenschaften* of Hegel is his counter magnum opus – a veritable dialectical negation of Newton.

Hegel differed with Newton on a wide range of fundamental concepts of epistemology and ontology; on the criteria of positive knowledge, the notions of space, time, matter, motion, force etc.; the relation between mathematics and physics etc. and had a completely different world views in general. For Hegel, "reason"- guided "comprehending" of the notions is the most essential element for any knowledge of Nature; in contrast to any sensualistic and crass empirical approach, which deny even the status of "thinking consideration of Nature", on the contrary insisting on the arbitrary and random approach of *economically* dealing with sensual perceptions and a mathematical approach that is considered as the most *"economical"*, *"quantitative"* and *"exact"* determination of Nature. This "view of understanding" is what Hegel calls metaphysics, because this is unscientific.

Hegel's view on the relation between mathematics and physics is in extreme opposition to Newton's. Hegel goes so far as to call the ambition to mathematically prove theorems of physics "ridiculous." The reason for this extreme reaction of Hegel towards Newtonian science can be discerned from the very first sentence of the Foreword [15] 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; 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 mathematical

abstraction and the thought world; rejecting philosophical notions as metaphysics! From that time on, the “consistency of mathematics” and the rational mathematical relations alone became the primary tool of theoretical physics. Mathematics became “the language” of physics! Empirical experience and positive knowledge had to be forced through the tunnel of mathematical pipeline. Just to take an example from Newton himself: Newton’s First and Third laws are conceptual laws with no mathematics directly involved. Newton cannot take a single step in terrestrial Nature without the “equal and opposite reaction” (a dialectical contradiction!) of his Third law, but he disposes it off completely in his one-sided law of the universal gravitational attraction in extraterrestrial dynamics. Without the balancing factor of the Third Law (the recognition of dialectical contradictions in Nature), modern astrophysics has lost its qualitative character, depending on the fictitious quantitative mathematical relations and the “force” of the Second Law of motion.

Einstein, with his mathematical idealism elevated Newtonian physics to the idealist extreme with the following words [16], “Our experience hitherto justifies us in believing that nature is the realization of the simplest conceivable mathematical ideas. I am convinced that we can discover by means of purely mathematical constructions the concepts and the laws connecting them with each other, which furnish the key to the understanding of natural phenomena. ... In a certain sense, therefore, I hold it true that pure thought can grasp reality, as the ancients dreamed”. For Einstein inspired modern theoretical physicists, mathematics is not merely a tool of scientific enquiry, but the very element of ontology and the *a priori* determinant of the universe [17]. This is a proposition that Hegel’s dialectics rejects totally; as Frederick Engels [18] wrote, *Like all other sciences, mathematics arose out of the need of man; from measurement of land and of the content of vessels, from computation of time & mechanics. But, as in every department of thought, at a certain stage of development the laws abstracted from the real world become divorced from the real world and are set over against it as something independent, as laws coming from outside to which the world has to conform. This took place in society and in the state, and in this way, and not otherwise, pure mathematics is subsequently applied to the world, although it is borrowed from this same world and only represents one section of its forms of interconnection – and it is only just precisely because of this that it can be applied at all.*”

#### **Interpretations of Kepler’s Laws: Newton vs. Leibniz and Hegel**

Kepler’s three laws faithfully reflected the tedious, scrupulous and the painstaking data on the planetary motions of the solar system by Tycho Brahe. These are:

**Kepler’s First Law:** *The orbit of a planet about the Sun is an ellipse with the Sun at one focus.*

**Kepler’s Second Law:** *A line joining a planet and the Sun sweeps out equal areas in equal intervals of time.*

**Kepler’s Third Law:** *The squares of the sidereal periods of the planets are proportional to the cubes of their semimajor axes.* Or,  $P^2$  is proportional to  $a^3$ , where  $P$  is the sidereal period and  $a$  is the semimajor axis of the planet going around the sun. A proportionality constant  $(4\pi^2/GM)$  gives Newton’s formula  $P^2 = (4\pi^2/GM) a^3$ , where  $G$  is the gravitational constant and  $M$  is the mass of the sun.

#### **Newton:**

Newton made an idealistic interpretation of Kepler’s laws. He totally disregarded Kepler’s first and second law, assumed a perfect circle of Ptolemy as the orbit of the planets and used his theory of unidirectional universal gravitational attraction, using a perfectly fitting centrifugal force, perfectly balancing the gravitational pull inwards such that there is zero outward force producing a perfect equilibrium. Newton simply compared the motion of a planet going around the sun with a stone tied to a string and rotated in a circle manually. The centrifugal motion of the stone being balanced by the tension of the string. The gravitational “pull” of the sun then is equal to the centripetal force of the planet, in the following way:

$$F_g = \frac{GMm}{r^2} \quad (1)$$

$$F_c = \frac{mv^2}{r} \quad (2)$$

Where  $F_g$  and  $F_c$  are the gravitational pull and centripetal force,  $M$  and  $m$  are the masses of the sun and the planet respectively,  $v$  the velocity of the planet and  $r$  is the radial distance from the sun in a circular orbit.

$$v = \frac{2\pi r}{P} \quad (3)$$

where  $P$  is the period of planetary cycle.

So, setting the forces equal, yields

$$\frac{GMm}{r^2} = \frac{mv^2}{r} \quad (4)$$

Where  $r$  is the radius of a circular orbit; unlike Kepler’s elliptical one.

Note that the mass  $m$  of the planet will cancel out, so that the circular orbital motion is independent of the mass of the orbiting body and the relation becomes,

$$\frac{GM}{r^2} = \frac{(2\pi r)^2}{rP^2} \quad (5)$$

which on rearrangement gives

$$P^2 = \left(\frac{4\pi^2}{GM}\right) r^3 \quad (6)$$

that satisfies Kepler's third law.

This assumes an ideal Goldilocks-like condition where the planet must circle the sun at uniform speed at a constant distance from the sun with an outward tangential force exactly balancing the inward gravitational force at each point of the orbit and a planet from distance must approach the sun at an optimum velocity and direction to fulfil the perfect equilibrium (no contradiction) condition for all time to come - a condition that only a God's hand can accomplish. The anomalies found in the real solar system (dictated by Brahe's impeccable observational data and by Kepler's laws) is simply attributed in retrospect (without any evidence) to the effect of other planets by Newton and his followers till today! Kepler from the observational data of Brahe assumed an elliptical orbit *a priori* and never considered the effect from other planets on a particular one. In an elliptical orbit where the velocity of the planet goes through a cycle of maximum and minimum, God's hand has to be there to steer the planet in its course; a point Hegel refers to, in his comment quoted above. But what we see in reality and what even the latest data from NASA rather agrees more closely with Kepler and Hegelian contradictions in the solar system [2]!

It now appears that in a significant but obscure publication (like many others including even some of Einstein's), conveniently ignored or forgotten by mainstream physics, E.J. Aiton [5a] throws some new light on the history of the theories of celestial motion and on the conflict between Newton and Leibniz; not only on the authorship of calculus, but also on the interpretation of Kepler's Laws of Planetary Motion.

Aiton [5a] wrote, "In an early notebook known as the Waste Book, Newton wrote: 'All bodies moved circularly have an endeavour from centre about which they move'. As late as 1681, in describing the orbit of a comet, he wrote of *vis centrifuga* overpowering the attraction and forcing the comet, notwithstanding the attraction, to begin to recede from the sun. There is no mention of centrifugal force in Newton's Principia (1687), but in one of his attacks on Leibniz in 1711, Newton says that centrifugal force is always equal and opposite to the force of gravity by the Third Law of motion".

#### **Leibniz:**

Aiton [5a] further notes that Leibniz took into account both the centrifugal and centripetal forces and derived the radial acceleration expressed as:

$$\frac{\partial^2 r}{\partial t^2} = \frac{a}{r^3} - \frac{b}{r^2} \quad (7)$$

Where  $a$  and  $b$  are constants and  $r$  is the radial distance from the centre of attraction, the first and the second terms on the righthand side are the centrifugal and the centripetal forces respectively.

According to Aiton [5a], "Newton objected that since centrifugal force was equal and opposite to attraction by his Third Law of motion, Leibniz's reasoning implied that  $\partial^2 r/\partial t^2 = 0$ . Leibniz's formula in fact gives a correct measure of the radial acceleration and is a notable contribution, which his contemporaries failed to appreciate. Quite clearly, Newton and Leibniz are using the term 'centrifugal force' in different senses. Newton should have recognized this, as he had for nearly twenty years himself understood the term in Leibniz's sense. His intention, however, was not to understand Leibniz, but to denigrate his work". We all know what followed thereafter.

It is quite clear that, unlike Newton's view, the contention of Leibniz and also of Hegel's dialectics is that the centrifugal and the centripetal are two different and independent forces acting on the planets and the comets. In a recent "ResearchGate" publication, F.D. Tombe [5b] deduced Leibniz's radial planetary orbital equation from a consideration of the elliptical orbit of planetary motion and Kepler's Laws.

#### **Hegel:**

The following is what Hegel had to say on this issue [6b]:, "§ 212.(1) The motion of bodies of relative centrality, in relation to bodies of abstract, general centrality, is absolutely free motion, and the conclusion of this system is that the general central body is brought together through relative centrality with dependent corporeality. As is well-known, the laws of absolutely free motion were discovered by Kepler, a discovery of immortal fame. Kepler proved them, too, in the sense that he found the general expression for the empirical data (cf § 145). Since then it has become a commonplace that Newton first found the proofs of these laws. Not often has fame been more unjustly transferred from the first discoverer to another. Here I only want to point out what has basically already been admitted by mathematicians, namely: (1) that the Newtonian formulas can be derived from Keplerian laws; (2) that the Newtonian proof of the proposition that a body governed by the law of gravitation moves in an ellipse around the central body proceeds in general in a conic section, whereas the main point that was to be proven consists precisely in this, that the course of such a body is neither a circle nor any other conic section, but solely the ellipse. The conditions which make the course of the body into a specific conic section are referred back to an empirical condition, namely, a particular situation of the body at a specific point in time, and to the contingent

strength of an impulse which it is supposed to have received at the beginning. (3) Newton's 'law' of the force of gravity has likewise only been demonstrated inductively from experience. 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".

Kepler's Third Law does not refer to any mysterious force, but only in terms of what Hegel called the "absolute dynamics" of "absolute free motions" of the cosmic bodies, which are mediated by the contradiction of attraction of "free fall" and the repulsion of the tendency to "fly away". This contrasts with a material body, for example a piece of stone on the surface of a large cosmic body like the earth for example, where the piece of stone (a "dead body") has lost absolute "free motion"; but it is held under the overwhelming gravitational force of the larger body free of contradictory forces acting on the stone. What Hegel calls Newton's jugglery is that Newton eliminated the difference between the two cases above, by incorporating a mysterious "first impulse" in the case the cosmic bodies, because Newton cannot explain the origin neither of motion, nor of matter; these according to him, come from God.

On gravity: Where gravity is the one-sided universal attractive "force" for Newton, for Hegel it is the dialectical contradiction of the of the unity of the opposites of attraction and repulsion. Hegel deduces gravity in the following way [6b]: §204. "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".

On finite and absolute dynamics: Based on his philosophical notions of space, time, matter and motion; Hegel made fundamental distinction between "finite mechanics" on terrestrial earth and the "absolute mechanics" of "free motion" of the heavenly bodies – a distinction that Newton eliminated with his mystical "force" and the magic of mathematics. The above two fundamental conceptual and methodological differences define the reasons why the dialectical view of Hegel totally rejected Newton's interpretation of Kepler's laws in particular and his (Newton's) cosmology in general and by extension Einstein's (theories of relativity based) cosmology as well. In a long and specific dissertation [19] on planetary motion, "Dissertatio Philosophica de Orbitis Planetarum – Philosophische Erörterung über die Planetenbahnen" Hegel discusses the logical contradictions of Newton's interpretation of Kepler's laws based on infinitesimal calculus; a point also made by Aiton [5,a] in his historical article.

To take into account the dialectical contradiction in the planetary motion as Hegel suggested; one can consider a latent force pushing the planets outward like a repulsive force. According to Newton, where  $G$  is the gravitational constant, the force  $F$  on a body  $m$  by the central body  $M$  at a distance  $r$  is given by,

$$F = \frac{GMm}{r^2} \quad (8)$$

Newtonian mechanics implies that the gravitational potential due to a spherical shell of matter can be considered to be located at the centre of mass and that a spherical shell of matter produce no net force on a body inside the shell, so the shells with radii greater than  $r$  will make no contribution to the force on  $m$ .

The motion of the test body  $m$  in the field of a fixed-point mass  $M$  can be understood by considering the Newtonian gravitational potential energy  $E_P$  on  $m$  given by;

$$E_p = -\frac{GMm}{r} \quad (9)$$

where  $r$  is the distance between  $M$  and  $m$ ,

If we consider that the centrifugal force of Leibniz and the "free motion" of Hegel are jointly pushing  $m$  outwards, then we can add some additional terms in Newton's equation, reflecting this force (and the contradiction), which is independent of the central body but is a function only of  $m$  and  $r$  as shown below:

$$E_p = \frac{ma}{r^3} - \frac{GMm}{r} - mCr^n \quad (10)$$

where  $a/r^3$  corresponds to Leibniz's centrifugal force and  $Cr^n$  is a term corresponding to Hegel's "free motion"; where  $a$  and  $C$  are constants and  $n$  is an integer satisfying the power law of absolute mechanics, like Kepler's power law  $P^2$  proportional to  $a^3$ . The constants  $a$ ,  $C$  and  $n$  are to be determined from empirical and observational evidence.

The first and the third terms on the right hand side of equation (10) correspond to an outward force on mass  $m$ , but independent of mass  $M$  at the centre. The potential energy function is strongly negative both at very small  $r$  and at very large  $r$ . For small  $r$  only the potential energy term  $(GMm)/r$  representing Newtonian gravitational attraction is significant and the other two terms are negligible. For large  $r$ , only the  $Cmr^n$  term is significant, where the body  $m$  would have "absolute free motion". The potential energy  $E_P$  would have a maximum value at some



intermediate value of  $r$ , which represents the optimum condition for the contradiction of a pseudo-stable orbit of mass  $m$ , representing all the factors of a particular planetary orbit.

The Fig. 1[A] below shows a simplified plot of the equation (10) for  $n = 2$ . If the Leibniz's term,

$$m\left(\frac{a}{r^3}\right)$$

in equation (10) is replaced by the escape velocity

$$\sqrt{\frac{2GM}{r}}$$

then the plot becomes a continuous parabola as shown in Fig. 1[B]

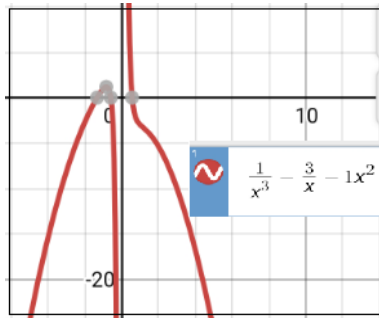


Fig. 1[A]

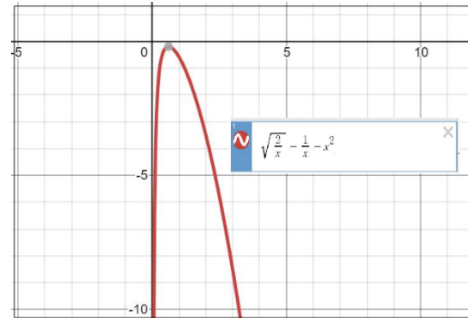


Fig. 1[B]

The potential energy  $E_P$  for  $n = 2$  will be maximum when the following condition is satisfied:

$$\frac{dE_P}{dr} = -\frac{3ma}{r^4} + \frac{GMm}{r^2} - 2Cmr = 0 \quad (11)$$

$$\text{Thus, } \frac{GM}{r^2} = \frac{3a}{r^4} + 2Cr \quad (12)$$

A particular planet will remain in pseudo-stable orbit, if these conditions are satisfied.

Multiplying (12) by  $m$  on both sides gives Newton's gravitational "force"  $GMm/r^2$  on the left hand side

$$\frac{GMm}{r^2} = m\frac{3a}{r^4} + 2Cmr \quad (13)$$

This implies that, unlike Newton's single and unidirectional force of universal gravitational attraction, the contradiction of the opposite centrifugal force suggested by Leibniz and the inferred "free motion" term of Hegel remains active on any orbiting cosmic bodies around a centre and probably can explain for example, the advance of the perihelion of the planets, the orbital eccentricity, the high escape velocity and the high orbital motion of the stars at the periphery of the galaxies and of galaxies at the periphery of the clusters etc. and other cosmic phenomena [2] without the necessity of fantastic "spacetime" warping or hypothetical dark matter, dark energy, black holes etc.

### Conclusion:

The anti-dialectical Newtonian concept of gravity as an unidirectional universal attractive force and later Einsteinian esoteric theories of astrophysics based solely on mathematical idealism have only helped the proliferation of mysteries and unknowable dark/black cosmic objects, but no positive knowledge of the cosmos. This approach has severely undermined the discovery of the phenomenological Laws like those of Kepler, which are the primary basis to gain knowledge of the universe. Only a dialectical approach as initiated by Leibniz and Hegel can help mankind to gain progressively better knowledge of the dynamics, transformation and the evolution of the cosmic bodies and other phenomena from the macrocosm of the galaxies to the microcosm of the quantum world [20, 21].

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