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GALILEO AND DIALECTICAL MATERIALISM OF THE TWENTIETH CENTURY

It is a revealing experience to obtain a panoramic view of Galileo's boundless contributions to the growth of physical science three and one-half centuries after this pioneering giant expounded his ideas in historical Pisa. Indeed these ideas – indicating the primary value of aposterioristic truth through experimental science – were a striking and uncomfortable novelty to Galileo's contemporaries and we know only too well the story of various difficulties that occurred to the Arcetri wizard.

In the fourth century since Galileo's dramatic performance of the law of freely falling bodies at the Inclined Tower of Pisa, the evolution of scientific ideas and the concept of physical reality have undergone most startling reversals. Undoubtedly, the macrophysical world in which Galileo exclusively operated turned out to be widely different from the microphysical world which is the sole operational domain of relativistic and quantum physics. C. F. v. Weizsäcker states ⁽¹⁾:

« Physics began with the determination of the laws which satisfy the events immediately perceptible by the senses, but now its goal is precisely to investigate the atomic world, which is no longer perceptible by the senses, and to reduce all other types of order to the laws of atomic processes ».

Indeed, we can state that with Galileo, physics started the investigation of the laws regulating the phenomena of macrocosmic order that are readily accessible to our normal perception. At the same time, the initiation of experimental method placed Galileo into a most dramatic role, that of a witness, with his variety of experiments and observational facts, to the exclusive value of such physical reality as displayed in the Copernican scheme of the universe. Yet, this system and Galileo's arguments in its support, have undergone vast changes, particularly through an epistemological shock with the « fai-

lure » of the Michelson experiment. The negative aspect of the Michelson experiment did not mean a return to the Ptolemaic world view but it suggested the necessity for a new philosophy of physical reality. No doubt, it was the Michelson experiment which adumbrated a great revolution in physics that with the vast and unforeseeable consequences of the principle of relativity is still very far from spending its effect and impact upon the torrential revision of the classical ideas in physics.

From the Galilean foundation of experimental science to the time of the birth of the new physics, we have the classical period which, culminating in Newtonian physics and its mechanistic world view, carries the lasting vestiges of the great Tuscanian. It is the period of triumphant mathematical rationalism and technological empiricism. It is characterized by such works as that of Laplace or Leverrier in astronomy or Kelvin and Helmholtz in physics. Its intellectual climax was reached in the middle of the nineteenth century with Faraday and J. C. Maxwell and perhaps most appropriately described in the historical statement of the physicist, Albert Michelson, by 1893 in which he maintained that physics as knowledge reached its final and completed shape, its advancement consisting only in the position of the decimal point. History has shown that this was only an epistemological epitaph to classical physics.

Thus, through the nineteenth century we witness not only a most successful stride, the glittering results of experimental science, and the rise of technology, but – what is of primary interest to us at this point – its influence on human thinking, on the formation of philosophy and the social life of man. Most nineteenth century writers present the traditional heroic picture of Galileo as a tragic victim and martyr in the vicissitudes of scientific progress. As the model of the deterministic universe was boldly silhouetted behind the gossamer of the Laplacean and Maxwellian equations in the mind of ambitious and optimistic technologists and engineers of the nineteenth century, Auguste Comte's positivism rose in France to rival in popularity with its kin philosophical doctrine of dialectical materialism in Germany – both nurtured by the triumphs of scientific thought and its Weltanschauung. Galileo, his work, struggle and persecution, loom high in the background of these schools of thought, standing at the cradle of their formative ideas, that were to inspire the historic rise of a powerful social and political system of the twentieth century and permeate its foundation and intellectual dominion.

One wonders how dialectical materialism, the official school of thought to which a vast part of humanity is today exposed, could so closely be involved and interwoven with physical science? Dialectics, the reality of change caused by struggling opposites, although promulgated by Hegel, as an idea has its history since the ancient Greek school of philosophy of Heraclitus. For Hegel, dialectics

gravitates in the theologico-philosophical realm, the contradiction being expressed between the absolute, Divine Mind and the finite mind of man. Hegel's is the dialectics of an absolute idealism. Likewise materialism, the primacy and objective reality of matter, has its distinct ancestry in Greek antiquity. Revived in the eighteenth century, it became fashionable among French materialists, until it shaped into the refined and popular system of Auguste Comte's positivism. This occurred in the very time of the golden era of physical science. The progressive drift away from Hegelian idealism was built up by Feuerbach, Bauer and other young Hegelians until we observe the emergence of two outstanding and historical personalities, Karl Marx and Friedrich Engels, who were to shape the destiny of an era. The very fact that Marx and Engels appear at that historical moment is in itself considered symptomatic for they both claimed the scientific age to be the age of the proletarians.

As a reaction against Hegelian idealism, it is perhaps Marx and Engels more than anyone else that are responsible for the historic combination of dialectics with materialism. In their view science and scientific method completely justified this appropriate union. It was in this atmosphere of the middle of the nineteenth century, pregnant with the constant flow of new scientific discoveries of the first magnitude, that Marx shaped and believed to have discovered the key to human life in economic categories in which his materialism took the form of economic determinism, strangely parallel to the deterministic universe of the physicists. Marxian dialectics takes the form of class struggle and the social and historical existence of man becomes the measure of all and everything. Marx, however, never thought of constructing an all-inclusive philosophical or ideological system and concept of the world out of the vast realm of his prolific mind. This was started by his life-long friend and supporter, Engels, and continued vaguely and cumulatively by various followers, Lenin in particular. Thus we have at present, in the middle of the twentieth century, the dialectical materialism of Marxist-Leninist version that directs the way in which any textbook must be written wherever Marxists hold their political dominion. The Marxist doctrinaires are usually inclined to attach the adjective « scientific » to their system of philosophy. After all, Marx denied the need for any philosophy and Engels advocated that philosophy perished with the growth of science.

A glance at some actual text in recent literature may be illuminating. Thus, in « Die Entwicklung im Universum » from Dr. Walter Hollitscher, professor of philosophy at Humboldt University in East Berlin, we find repeated emphasis on:

« ...the material and objective character of natural phenomena as an indispensable basis of every observation of nature against any mystical exposition of nature whose representatives were and are, for instance, Jeans, Eddington, Jordan and Weizsäcker ».

In the Czech Astronomical Monthly ⁽²⁾ we find in V. Rumel's analysis of Engel's « Dialectics of Nature » the following statement in reference to the well-known physicist, Heisenberg, whose name is associated with the concept in modern physics – The Uncertainty Principle:

« One of the contemporary scientists and also a fighting reactionary, Heisenberg, accepts the ancient idea that mathematical structures attach a meaning to phenomena ».

It is quite revealing that in the past ten years this same astronomical journal at various occasions published full front page pictures of Marx, Engels, Lenin and other ideological leaders of dialectic materialism whereas the passing of distinguished astronomers and physicists, including Einstein, was noted with an insignificant column. Control or prevention of access to the writings of refuted Eddington, Jeans, Weizsäcker and quite a few others, including to some extent even Einstein, indicates the historical parallel which Galileo faced in his time when any person refuting the Ptolemaic system endangered his standing in conformist society. Dialectical materialism is not in itself an unacceptable philosophy. It has its significant place in the history of man's growing ideas. Yet, it does not represent any last word in man's quest for knowledge. When Marxist doctrinaires speak from the chair of their political sovereignty, they run into serious, historical peril if they advocate, as they do, that they have adopted the highest science when they have built it on the foundation of dialectic materialism. This argument reminds us of that of the scholasticism when they confronted Galileo from their position of power. Thus, Marxists fail to learn from history and sow the seed of dogma of their own.

Furthermore, in the field of astronomy and physics the viewpoint of the authoritarian dialectical materialists is fast becoming a fossil ideology since it stagnated at a definite Newtonian level which experienced its fruition in the second half of the nineteenth century. It is curious that this was exactly the period in which Marx and Engels shaped their ideas under the influence of the golden decades of Galilean experimental science and its successful application in industry. This was a formidable argument in support of materialism and economic determinism. Indeed, this made most Marxists passionate and prophetic dogmatists and in shaping their universal ideology they included confidently the entire world picture of classical physics as was then in vogue by contemporaries of Marx and Engels. It is the view of a mechanistic universe in which human society or the human being is but a little more complex machine following an inexorably deterministic pathway. This fitted perfectly into the vision of the Marxist economic scheme. It is the time when the mathematical rationalist, Laplace, produced an overwhelming impression upon the entire century with his equations that supplemented an ingenious hypothesis on the origin of the solar system. It is

the era when Kelvin's statement resounded as a sacred gospel through all the physics laboratories: « Whatever you can express in number, you know something about, whatever you cannot put in number, you know nothing about ». Yet, over all this towered Newton and his mathematical physics with the universal law of gravitation. Consequently, textbooks under Marxist guidance advocate that the universe is infinite and boundless, in conformity with the Newtonian concept. As adepts of the classical world view, the dialectical materialists refute the « dangerous » misguided Einsteinian idea which maintains that though boundless the universe must inevitably be finite.

Since Galileo initiated his new science many changes have occurred that the Marxist dialecticians fail to apprehend in their monolithic attitude. According to classical Galilean-Newtonian physics, the statement by Einstein in his Herbert Spencer lecture in Oxford would alone be short of sheer heresy (3):

« It is my conviction that pure mathematical construction enables us to discover concepts and the laws connecting them, which give us the key to the understanding of the phenomena of nature. Experience can, of course, guide us in our choice of serviceable mathematical concepts, it cannot possibly be the source from which they are derived. In a certain sense, therefore, I hold it to be true that pure thought is competent to comprehend the real as the ancients dreamed ».

What, then, is reality when experience cannot possibly be the source from which serviceable mathematical concepts are derived? Ossiander, therefore, uttered a prophetic view more than four centuries ago in his apologetic introduction to the first edition of Copernicus' « De Orbium Coelestium » where he attempts to tone down the disturbing radicalism of the heliocentric doctrine:

« It is neither necessary an hypothesis be true nor even probable but it is sufficient if it renders calculations consistent with observation ».

If the views of both Einstein and Ossiander indicate a strong pragmatic flavor, they both also reveal that human thought is the inventor of reality. Thus, an experiment is not a guarantee of reality, or, as Einstein points out, sense perception only gives information of this external world or of « physical reality » indirectly. We can only grasp « physical reality » by speculative means.

Against aposterioristic knowledge which is the inviolable conviction of the present empirical science and of dialectical materialism, Einstein goes so far as to use the language of idealistic philosophy which advocates the guidance of an aprioristic knowledge (4). Center of gravity, density, vector, latitude, etc., are some of many mental concepts used in physics that appear very real, yet actually do not exist. « Science is a creation of the human mind, with its freely invented ideas and concepts ». In this train of ideas, considering

the evasive concepts of microcosmic ultimate particles as electron or quantum, Jean's statement (5) is most radical indeed when he describes our universe as one great thought. The universe is whatever idea we create of it inside the frame of our sensory system and in the realm of our intellectual level and degree of mental activity. Eddington startles us saying that Rutherford did not discover proton in the nucleus of the atom but he has put it there. This challenging mathematical astrophysicist maintains that although scientific progress has eliminated any fantasy of the spirit in order to clear the trail toward reality, it has arrived at the conclusion that the greatest reality is inseparably associated with the ability to arouse those very fantasies. Yet, according to Eddington (6), that is only because spirit or mind, the mysterious weaver of illusions, is the only warrant of reality and also that it is possible to find reality in the foundation of each fantasy. I believe the history of concepts and theories in physical science amply justifies Eddington's opinion.

It appears the only valid reality for man's individual life is the world picture impressed upon his mind by his sensory system. The consequences of the principle of relativity have indicated its plausibility. The new physics, whether called Einsteinian or quantum physics which brings us to the borderland between what is « real » and what is « sense delusion », has undeniably shattered the foundation of materialism and Comte's positivism. Even the law of causality is challenged by such aspects of microcosmic phenomena as implied in Heisenberg's principle of indeterminacy that is beyond the range of our ordinary perception. Instrumentalism does not remove the dilemma of our bondage to sense perception. Whether it be the spectroscope, telescope, microscope or cloud chamber or any other laboratory tool, they only magnify, extend or alternate the field in which all the phenomena still have to be processed through our sensory framework. At the time of Galileo, it was a revealing novelty to observe the four satellites revolving about Jupiter and not about the earth, suggesting the weakened importance of the illusory geocentric universe. But once the earth's motion was established by more persuasive evidence than Galileo's eloquent pleading in his Dialogues, it remains ever more an enigma for Galilean science to interpret today the negative result of the Michelson's experiment. In replacing one illusion of « reality » by another, we erroneously attempt to explain one external event by another external event, disregarding the imperfection in the framework of our sensory system. In this type of search we are like the explorer who seeks the cause of the projected image on the screen while disregarding the projection machine that produces the image. It is man, himself, the least known reality, who fathers these changing, projected thought images of our universe, and these he tries to inter-communicate, however imperfectly. Scientific truth evolves only very slowly and, in addition each change of scientific thought is a mere

creation of new words applied to the old tune, and the old image is not destroyed but refocussed. Yet, therein rests the value of science – through the realization of ever recurrent errors and illusions along the pathway toward an ever higher consciousness.

Thus, dialectical materialism which under the Marxist-Leninist version occupies a position of power and authority in present communist countries, through this very fact is exposed to danger as were all groups vested in power. Dialectical materialism, as a school of thought without power, once grew hopefully, nurtured by the heritage of Galileo's pioneering work, but now, in its authoritarian isolation, exposed to stagnation, it is readily inclined to dogmatization. It thus follows an inevitable drift toward the same historic role scholastics occupied in relation to Galileo when they assumed their views to be infallible. In other words, the authoritarian Marxists today, no matter how loudly they proclaim themselves the custodians of science and scientific progress, by the very power they possess will perform all acts that invariably and in due course have choked the spirit of free scientific inquiry, the only condition for the advancement of true science.

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