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Frederick Engels and Modern Science- A Bicentenary Tribute

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Frederick Engels, leader and teacher of the working class, was born on November 28, 1820 at Barmen in Rhineland. Because of his joint authorship with Karl Marx of the *Communist Manifesto* and many other works, and his yeoman efforts to bring out Volumes 2 and 3 of Marx's monumental work *Capital* posthumously, Engels' name has been linked up very closely indeed with Marx's. Hence to give a separate identity to him, and make an assessment of Frederick Engels as a leader of the working class, poses a serious challenge to any biographer.

This submergence of Engels' name within Marx's reputation is partly due to his own deference to Marx arising from his unbounded comradeship and love for him. His self-deprecating modesty would make him say, "Marx was a genius, we were merely talented." He also referred to himself as "someone who played second fiddle to Marx". Such writing from Engels has indirectly led to a lack of appreciation of his own contribution to Marxist theory.

But as an introduction to this essay we can describe Engels' importance briefly, as he himself described Marx when he had said: "Just as Darwin discovered the law of the development of organic nature, so Marx discovered the law of development of human history…" We can equally say: "Just as Newton discovered the law of universal gravitation, which was behind the regularity of the motions of the planets, so Engels discovered in the working class, which was then a merely suffering mass, its potential leading role in the future movement of human society from capitalism to socialism".

In the present piece we do not propose to discuss Engels' political and organizational work. We limit ourselves to his contribution to the philosophy of dialectical materialism, and its impact on the science of his day and on modern science. However, before that we must refer to his contribution to the drafting of the *Communist Manifesto*.

(I)

The Communist Manifesto

Engels' personal contribution in the writing of the *Communist Manifesto* is often under-estimated. Lenin points out in *The Marx-Engels Correspondence*, that under conditions where people were floundering amidst countless pseudo-socialist trends and factions, "Engels was able to find his way to *proletarian*

socialism, without fearing to break off relations with the mass of well intentioned people, ardent revolutionaries but bad communists."

Engels' attention was focused on the main socialist doctrine which was current in the early 1840s, namely, Proudhonism. Even before Proudhon had published his book *Philosophy of Poverty* in 1846, or Marx had prepared his response, *The Poverty of Philosophy*, in 1847, Engels had subjected Proudhon's basic ideas to ruthless criticism. In 1846 itself Engels already had the fundamental ideas of the doctrine which is now known as Marxism.

In those days communism in Germany was a form of expression of the opposition sentiments of all, and chiefly of the bourgeoisie. In his letter dated February 22, 1845 Engels wrote: "The most stupid people, the most lazy and most philistine people, whom nothing in the world interested, are almost becoming enthusiastic for Communism."

On October 23, 1846 the twenty-six year old Engels wrote: "The Proudhon Association's scheme was discussed for three evenings. At first I had nearly the whole clique against me… The chief point was to prove the necessity of revolution by force." When Engels demanded a vote in the meeting on who were communists the members began to argue that they had met together merely to discuss "the good of mankind", and they insisted that they should know what communism really was. The meeting was taking place in Paris where Engels was then staying.

Engels gave them an extremely simple definition: "I therefore defined the objects of the Communists in this way: 1) to achieve the interests of the proletarian in opposition to those of the bourgeoise; 2) To do this through the abolition of private property and its replacement by community of goods; 3) To recognize no means of carrying out these objects other than a democratic revolution by force."

Lenin pays a handsome compliment to Engels when he says that this was written one-and-a-half years before the 1848 revolution, and he recognizes that **the foundations of the Social Democratic Labour Party of Germany were laid at this Paris meeting.**

A year after this meeting, Engels wrote to Marx a letter dated November 23, 1847 in which he said that he had prepared a draft of the Communist Manifesto. In this letter Engels writes, "I begin: What is communism? And then straight to the proletariat –history of its origin, difference from former workers, development of the contradiction between the proletariat and bourgeoisie, crises, results… In conclusion the party policy of the Communists"

This clearly shows that Engels had with him the main outlines of the theory much before Marx and Engels together published their world famous book the *Communist Manifesto* in 1848.

Lenin refers to this letter to stress Engels' role in the joint authorship of the book. He states: "This historical letter of Engels on the first draft of a work which has travelled all over the world, and which to this day is true in all its fundamentals and actually topical as though it were written yesterday, clearly proves that Marx and Engels are justly named side by side as the founders of modern Socialism."

Marx and Engels independently discover the class struggle of the proletariat

In 1842 at the age of twenty-two Engels was sent to Manchester to work in the business in which his father was a partner. He spent two years there. While he was collecting material for his book, *Condition of the Working Class in England,* he came into direct contact with the lives of the workers. He took active part in the Chartist movement and was a regular contributor to their journal *Northern Star* and to Robert Owen's journal, *New Moral World*. He was to write later:

"While I was in Manchester, it was tangibly brought home to me that the economic facts, which have so far played no role or only a contemptible one in the writing of history, are, at least in the modern world, a decisive historical force; that they form the basis of the origination of the present day class antagonisms; that these class antagonisms, in countries where they have become fully developed, thanks to large scale industry, hence especially in England, are in their turn the basis of the formation of political parties and of party struggles, and thus of all political history. Marx had not only arrived at the same view, but had already, in the *German- French Annuals* (1844) generalized it to the effect that, speaking generally, it is not the state which conditions and regulates civil society, but civil society which conditions and regulates the state, and consequently, that policy and its history are to be explained from the economic relations and their development, and not *vice versa.* When I visited Marx in Paris in the summer of 1844, our complete **agreement in all theoretical fields** became evident and our joint work dates from that time."

The special feature of the class struggle of the proletariat is described by Engels in the following words: This class struggle is "distinguished from all earlier class struggles by this one thing, that the present day oppressed class, the proletariat, cannot achieve its emancipation without at the same time emancipating society as a whole from division into classes and, therefore, from class struggles".

This same fact is expressed poetically in the *Communist Manifesto*: "The proletariat, the lowest stratum of our present society, cannot stir, cannot raise itself up, without the whole superincumbent strata of official society being sprung into the air."

(II)

Construction of Dialectical Materialism

Dialectical materialism is made up of the following two concepts: (i) ***matter*****,** that which exists independently by itself, and whose existence does not depend on its being observed by someone, and (ii) ***dialectics*****,** which means motion or change and the contradictions within them. These are basic ideas to be found in all human cultures after the stage of the discovery of agriculture.

From the beginning of class society and exploitation, the ideas of confusing the real with something unreal, and the question of showing change as illusory, and the need for accepting the world and the human situation as they are, form the two main ideological tools of the exploiting classes. With the rise of class struggles also begins the opposition to both these tools. Thus we have Charvaka in Indian philosophy and Heraclitus and Democritus in western philosophy.

It is generally believed that Marx was the initiator and the one who developed the philosophy of dialectical materialism. It was then used by Engels to show that the same laws of dialectics make their appearance in the movement of nature, and they can be discerned in the physical sciences. This misunderstanding is partly because of some statements by Marx.

For example, in the preface to Volume 1 of *Capital* of 1867 he says: "My dialectic method is not only different from the Hegelian, but is its direct opposite….. The mystification which dialectic suffers in Hegel's hands, by no means prevents him from being the first to present its general form of working in a comprehensive and conscious manner. With him it is standing on its head. It must be turned right side up again, if you would discover the rational kernel within the mystical shell."

Contrary to this perception, dialectical materialism was developed jointly by Marx and Engels. Recall Engels' statement that he found "our complete agreement in all theoretical fields became evident and our joint work dates from that time". This agreement was not only in the matter of political economy, but in their world views as well.

Their first joint work, *The Holy Family* of 1844, shows that they had already come to a common and proper understanding of matter, motion, and consciousness. They had both moved from their earlier position of being Left Hegelians to a position of dialectical materialism. This book contains, in an embryonic form, the key idea of dialectical materialism, namely, its stand with regard to the existence of the world and its knowability. For example, with reference to Rene Descartes we have the following:

"Descartes in this *physics* endowed *matter* with self-creative power and conceived *mechanical motion* as the manifestation of its life. He completely separated his *physics* from his metaphysics. Within his physics, *matter* is the sole *substance*, the sole basis of being and of *knowledge*."

It is true that Marx used the dialectical method in his work on political economy, to take forward the work of Ricardo with reference to the definition of value, and in the analysis of historical processes, where he formulated the fundamental law of motion of human history. Engels realized that the very pattern of analysis of the historical processes, that they had developed prior to their meeting in 1844, could be applied to a much wider domain of study, which included the whole of nature and the physical sciences.

What is Dialectics?

An interesting introduction to the idea of dialectics can be seen in the following excerpt from Engels' Anti-Duhring[2]:

"When we consider and reflect upon nature at large or the history of mankind or our own intellectual activity, at first we see the picture of an endless entanglement of relations and reactions, permutations and combination, in which nothing remains what, where and as it was, but everything moves, changes, comes into being and passes away.[We see, therefore, at first the picture as a whole, with its individual parts still more or less kept in the background; we see the movements, transitions, connections, rather than the things that move, combine and are connected.] This primitive, naïve but intrinsically correct,

conception of the world is that of the *ancient Greek philosophy*, and was first clearly formulated by Heraclitus: **everything is, and is not, for everything is fluid, is constantly changing, constantly coming into being and passing away**."

"But this conception.. .does not suffice to explain the details… In order to understand these details we **must detach them** from their natural or historical connection and examine each one separately, its nature, special causes, effects, etc…."

"But this method of work has also left us as legacy the habit of observing natural objects and processes *in isolation*, apart from their connection with the vast whole; of observing them in repose, not in motion; as constants, not as essentially variables; in their death, not in their life. And when this way of looking at things was transferred by Bacon and Locke from natural science to philosophy, it begot the narrow, metaphysical mode of thought peculiar to the last century…."

"Dialectics, on the other hand, comprehends things and their representations, in their essential connection, concatenation, motion, origin and ending."

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Engels gives more details of dialectics in the beginning of his book *Dialectics of Nature*. He explains dialectics telescopically in the Plan Outlines in the following words: Dialectics as the science of universal inter-connection. Main laws: transformation of quantity and quality—mutual penetration of polar opposites and transformation into each other when carried to extremes—development through contradiction or negation of the negation ---spiral form of development.

What is dialectical materialism?

We have quoted Marx on the influence of Hegel on his work. In the same place he refers to Hegel as that mighty thinker. However, he says that he had to break with him because Hegel, though the first who brought dialectics in the field of study, had yet to be turned right side up, since his dialectics was standing on its head. Hegel was an idealist philosopher, and for him what was primary was **Idea**, and the world was an alienation of this idea.

Hegel had made a significant contribution to the development of philosophy when he elaborated the notion of dialectics from his study of dialectics in ancient philosophical traditions. It may be noted that the word '*dialogue'* contains the Greek root ' *dia',* which means 'to split into two, opposed, clashing.' He considered especially the process of human thinking, the movement of thought. He detected in this process the pattern of 'thesis-antithesis-synthesis'. According to him the world was dependent on Thought, (the capital T expressing the primacy of thought). He recognized the clash of opposites or the dialectic, as the driving force of all motion, or change.

Basically, this idea of universal change, and the process of change through the conflict of opposites, was a revolutionary idea, for it implied that the social reality was also subject to change through the clash of forces. It had deep implications for those who wanted social changes, for this showed that society is itself subject to change. It must be stated, however, that Hegel was himself a conservative and was a

supporter of the Prussian monarchy. He argued that the society of his time represented the highest possible form of social organization.

The followers of Hegel were divided into two camps, those who supported the monarchy and those who opposed it. In the second category belonged the younger lot like Ludwig Feuerbach, Karl Marx and Frederick Engels, who described themselves as Left Hegelians.

One important Young Hegelian, who salvaged dialectics from its reactionary possibilities, was Feuerbach. He was responsible to a great extent for Marx's and Engels' transition from idealism to materialism. In 1841 he wrote the book '*Essence of Christianity*' in which he officially placed materialism on the throne. But he was not able completely to overcome the customary prejudice against the term 'materialism'. He could not accept materialism fully as a philosophical system. Why was this?

Engels says this was because at that time the sciences had themselves not developed sufficiently. What was meant by materialism was a crude mechanical outlook on the world, as though the world was a complicated piece of machinery. This was the materialism in which nature moved, as in the planetary system, like a clock. In this view a Hand was required to wind up the clock. This was what can be called **mechanical materialism**.

Engels describes some recent fundamentally revolutionary developments in the field of science, which helped to change this outlook. These were the following three important discoveries: (i) the discovery of the living cell in 1838-39 by two scientists M.J.Schleiden and T. Schwann; (ii) the important discovery in science related to the transformation of energy by the work of Meyer, Joule, Grove, Colding and Helmoltz between 1842 and 1847, which showed that heat was a form of motion, and that it was possible to transform heat energy into motion and vice versa, and (iii) Darwin's discovery of the theory of evolution which was published in 1859. (For details see my book on Engels[10].)

Engels says about these great discoveries that they laid the foundation for a new outlook on nature: "The new outlook on nature was complete in its main features: all rigidity was dissolved, all fixity dissipated, all particularity that had been regarded as eternal became transient, the whole of nature was shown as moving in eternal flux and cyclical course." The time was ripe for a new world outlook, the view that the world was material and it was dialectical. Matter cannot exist without motion, change. It was self active, and in no need of any prime mover or a Hand to set it in motion. Matter is primary, mind is derivative. In the words of Engels, "Our consciousness and thinking, however supra-sensuous they may seem, are the product of a material organ, the brain. Matter is not a product of mind but mind itself is merely the highest product of matter".

In dialectical materialism, by bringing matter as the primary reality, and idea as derivative from matter, Hegel had indeed been overturned, and set right side up. It may be said that in the dialectics of Hegel matter was missing, and in the materialism of Feuerbach dialectics was missing. Marx and Engels succeeded in effecting a fruitful marriage of these ideas to create dialectical materialism.

(III)

Engels and Science

Engels maintained that nature was the test of dialectics**.** "Nature is the proof of dialectics, and it must be said for modern science that it has furnished this proof with very rich materials increasing daily, and thus has shown that, in the last resort, nature works dialectically and not metaphysically."[2]

He said: "Marx and I were pretty well the only people to rescue conscious dialectics from German philosophy and apply it in the material conception of nature and history. But a good knowledge of mathematics and natural science is essential to a conception of nature which is dialectical and at the same time materialist…. For this reason, when I retired from business and transferred my home to London, thus enabling myself to give the necessary time to it, I went through as complete as possible a "moulting", as Leibig calls it, in mathematics and the natural sciences, and spent the best part of eight years on it.."[2]

In *Dialectics of Nature*, Engels proceeds to use the sciences of physics, chemistry, mathematics, biology, anthropology, mechanics, astronomy, and other allied subjects to examine rigorously and demonstrate that the laws of dialectics, as stated above, do indeed hold in nature. In his **Outline**, which is fundamentally a plan for the chapter 'Basic Forms of Motion', he gives the following summary of the work: (1) Motion in general;(2) Attraction and repulsion; Transference of motion;(3) [Law of the] conservation of energy applied to this; Repulsion+attraction=energy;(4) Gravitation - heavenly bodies-terrestrial mechanics;(5)Physics,Heat,Electricity;(6)Chemistry;(7)Summary.

Because of the natural limits of space for a tribute essay such as this, I shall omit most of the examples from this book. However, I shall give two examples to show how Engels deals with the laws of contradiction and the law of the negation of the negation.

Engels has given a number of examples to illustrate the law of contradiction, the unity and struggles of opposites: "In mathematics: + and --, Differential and integral, In mechanics: action and reaction, In physics: positive and negative electricity, In chemistry: the combination and disassociation of atoms, In social sciences: the class struggle". Analyzing the contradictions of the contemporary theory of electricity, Engels "anticipated the theory of electrolytic dissociation." He exemplifies the unity of opposite charges in the following words: "Dynamic or voltaic electricity, on the other hand, is electricity produced by the conversion of chemical motion into electricity. Under certain definite conditions, it is produced by the solution of zinc, copper, etc. Here the tension is acute but not chronic. At every moment new + and – electricity is produced from some other form of motion, and already existing electricity is separated into + and --." There are many such examples he gives from a study of the sciences from his time. He refers to the work of the English physicist Frederick Guthrie and says: "A pretty example of dialectics of nature is the way in which according to the present day theory, *repulsion* of *like* magnetic poles is explained by the *attraction* of *like* electric currents."

Regarding the contradiction in **motion itself**, Engels says the following : "Motion itself is a contradiction: even a simple mechanical change of position can only come about through the body being at one and the same moment of time both in one place and in another place, being in one and the same place and also not in it. And the continuous origination and simultaneous solution of this contradiction is precisely

what motion is". This statement represents a very deep observation, for it gives us the dialectical opposites of 'locality-nonlocality', and the qualities of localizability and non-localizability. This contradiction is revealed in the concept of the wave-particle duality in modern quantum theory.

To explain the law of the negation of the negation, Engels gives the example of a grain of barley. When it falls on suitable soil, it ceases to be a grain of barley, and in its place appears a plant. At the second negation, the plant dies but it has produced grains of barley in its normal life process. Engels says: "As a result of this negation we have once again the original barley, but not a single unit, but ten-, twenty- or thirty-fold".

(IV)

Anti-Duhring and modern science

The book *Anti-Duhring* was written in 1878 by Engels at the behest of Marx. He asked him to deal with a new ideologue of socialism, Eugene Duhring, who had recently joined as a lecturer in Berlin University. In 1875 Dr Duhring announced that he had been converted to socialism, but that the entire idea had to be re-examined in the light of new and modern ideas. He brought out an entire philosophical system, including essays on space, time, natural science and morality. Engels says sarcastically that the "system creating Herr Duhring is by no means an isolated phenomenon in contemporary Germany". He speaks of the various themes that Herr Duhring was dealing with.

However, the danger was that "It became apparent that the new convert was being welcomed by a section of the socialist press" and this presented a new occasion for sectarian splitting and confusion developing within the Party. Marx was himself busy fighting liquidationism within the Party and dealing with the so called "Gotha unity programme" of 1875. So he asked Engels to deal with the issues raised by Duhring. However, as Engels says, *Anti-Duhring* was a joint work, with Marx contributing to the section on Political economy, and especially the chapter *From the Critical History.*

Anti-Duhring begins with an account of the philosophical development of society right from the time of slavery, feudalism, mercantile capitalism to mature capitalism. He explains the objective need of the respective ruling classes in each stage for an ideological weapon to keep the exploited class under subjugation. This ideological weapon was provided successively by magic, mysticism, and religious and philosophical theories. He describes the fight against the Roman Church in Europe during the struggle of the burghers against the feudal lords,(German Reformism).This struggle was indirectly helped by the Peasant wars of Germany[4] (1525-34) led by Thomas Munzer. The ideological struggle against the Church, was led by Martin Luther, from the side of the bourgeoise, eventually giving rise to Protestantism. As Engels said, "Luther and Munzer each fully represented his party by his doctrine, as well as by his character and action".

However, in the new class society so formed, religion was still required. Thus the struggle was repeated in this stage, where the rising bourgeoisie was in need of keeping the proletariat under its leash. In 1685 Newton had explained the motion of the planetary system without the need for the hypothesis of a Creator, (*hypothesis non fingo*). This gave rise, on the one hand, to the scientific materialist trend of

Voltaire and Diderot and the Encyclopedists .On the other hand, the idealist philosophers like Kant, brought in sophisticated arguments to show that there was a **being** who came first, and to show that there were things in the world which essentially could not be known (things in themselves).This represented the consolidation of idealism and agnosticism in philosophy.

In Chapter V on 'Time and Space', Engels deals with Duhring's arguments which try to show that both time and space were limited in extent. Duhring propounded the following **Thesis: The world has a beginning in time, and with regard to space is also limited**. This chapter is important because it shows how cleverly Duhring uses the notion of infinity in mathematics, by narrowing it down to the natural numbers 1,2,3,4,…., which forms an infinite sequence. He comes to the conclusion that the flow of time has a beginning .

Engels explains that this was a copy "word for word" from Kant's 1781 book *Critique of Pure Reason.* This was a rehash of the idea of Kant "that there was once a time when as yet there was no time, though there was a world."

Engels gives a detailed reply based on mathematics, *and the different kinds of infinity in mathematics*, and shows that Duhring was mistaken in his conclusions. But then Engels sums up the discussion with the following ringing words: **"The abstract requirement of a mathematician is, however, far from being a compulsory law for the world of reality."**

In present society also, the need remains for injecting confusion and mysticism into modern science, as a weapon to be used against the struggling classes. This question has been dealt with by me in detail in two articles in earlier issues of *Marxist* [12,13] . Quantum theory and the theory of relativity have both been exploited for this purpose. We have shown that, in the final analysis, the method used by the enemy is to place restrictions on reality as per "*abstract requirements of the mathematicians".* We have also shown how dialectical materialism helps us to overcome these obfuscations.

In particular, it is true that mathematical abstractions were misused to derive, from Einstein's relativity theory, conclusions about the **Big Bang**, or creation of the universe, and the **Black hole,** which blocks all information, and thus sets a limit on the knowability of the world.

In a much publicized 1988 book, *A Brief History of Time*, with runaway sales, it was claimed by Stephen Hawking that **time itself had a beginning**. This was a reincarnation of Duhring's thesis, according to which "time itself has a history". These claims have been exposed as false in my article *Dialectical Materialism and the Question of Black Holes*[13]. One may also look up chapter 6 of my book *Frederick Engels and Modern Science*[10], where I have essayed *'A Relook at the History of Time'.*

A prediction by Engels: Attraction and Repulsion

However, I wish to point out here that there exists a basic weakness in Einstein's theory itself. Both Newton's theory and Einstein's theory of gravitation are out and out attractive theories. This means that the attraction between two bodies goes on increasing as the distance between them decreases. There is

no limit to this growth of attraction. This property is what lies at the base of deriving the conclusions about the Big Bang and the Black hole.

Now, let us note here what Engels had said in 1878 about gravitation in *Dialectics of Nature* [3] :

"The whole theory of gravitation rests on saying that attraction is the essence of the matter. This is necessarily false. Where there is attraction, it must be complemented by repulsion…. The essence of the matter is attraction and repulsion…"(See pages 243,244).

Recent researches have testified to the truth of this observation. The conclusion that the world was created by the **Big Bang** was falsified by the **steady state theory** of Hoyle and Narlikar. In this theory they use a modified theory of gravitation, in which they include a new 'C-term' in Einstein's equations. Now in this new theory, attraction turns into repulsion when the distance between the objects is extremely small: "But when the test-particle gets very close to the isolated particle it is repelled".

This is what Narlikar[7] says: "By an isolated particle we mean a particle well separated from all others in the Universe. If we examine the motion of a test particle in the neighbourhood of such a particle, we find that it is first attracted by the isolated particle. But when the test particle gets very close to the isolated particle *it is repelled*… If gravitation changes sign and attraction changes to repulsion at very close range, this may explain why, for example, the massive galactic nuclei seem to be exploding rather than imploding."

It is interesting to note that this was written by Narlikar in 1977 exactly one hundred years after Engels was penning his *Dialectics of Nature.*

A more fundamental correction to Einstein's field equations is made by the Russian scientists, Logunov and Mestvirishvili [6.] . This is done in order to rescue Einstein's theory from the technical weakness of "not having a proper law for the conservation of energy". In this new **"relativistic theory of gravitation"** also, attraction changes to repulsion. They say: "Thus, the fact that the *graviton* has non-zero mass, irrespective of its magnitude, leads to repulsion of matter from the Schwarzschild sphere." (page 96).

Thus the prediction made by Engels in 1878, on the basis of the insights provided by dialectical materialism, is seen to be supported by the developments in physics in the second half of the twentieth century.

Superluminal speeds

Another example of Engels' perspicacity is seen in his reference to particles with speeds greater than the speed of light. He says in *Dialectics of Nature*, "In view of the enormous velocity of motion of electricity, even exceeding that of light, it remained difficult to overcome the view that here some material substance is in motion between the molecules of the body."

It is true, as stated in the preface to the book, that the speed of an electric current has subsequently been proved to be less than the speed of light. In note 99 of the book, an explanation is given that "it is

established in Einstein's relativity theory (1905) … that the velocity of light propagation in vacuum *c* is a universal physical constant and signifies speed limit."

However, the concept of superluminal speeds (velocities greater than light) is a potential tool for future investigative work. It needs to be noted that Einstein's special theory of relativity does not rule out speeds greater than the speed of light. What it says is that it is impossible to accelerate a particle moving at a smaller speed than light to a speed greater than light, because the mass of the particle increases infinitely as it approaches the speed of light. True, if **messages** can be sent with a speed exceeding the speed of light, then that would create a contradiction with Einstein's theory.

It has been suggested by some researchers that in conditions of extremely high pressures and densities, such as are to be found within the interiors of certain types of stars, shock waves could travel faster than light. Now shock waves are a kind of sound waves. Two scientists S.A.Bludman and M.A.Ruderman[1,8] have suggested that in ultra-dense matter the speed of sound would exceed the speed of light. This is expected to happen when the density of matter is higher than nuclear density.

These are challenges before the young researcher. But a precondition for success in this work is to imbibe the basic ideas of dialectical materialism, and to have the confidence that the above contradiction between Einstein's theory and the existence of superluminal motion can be resolved. For a possible line of investigation see chapter IV of *Dialectics, Relativity and* Quantum[9].

(V)

Scientific temper

For reasons of space I shall have to close this tribute without referring to the remarkable human qualities of this gentle intellectual giant. But I must touch on one quality that he and Marx had in common, and that was of being absolutely scientific in their investigations. They refused to make any comment which went beyond the remit of their investigations.

As an example, let us consider Engels' profound and widely acclaimed book of 1884, *The Origin of Family,etc*[5] . The following statement indicates how he rated the capacity of an honest scientific worker to make predictions about the distant future:

"Thus what we can conjecture at present about the regulation of sex relationships after the impending effacement of capitalist production is, in the main, of a negative character, limited mostly to what will vanish. But what will be added? That will be settled after a new generation has grown up: a generation of men who never in all their lives have had the occasion to purchase a woman's surrender either with money or with any other means of social power, and

of women who have never been obliged to surrender to any man out of any consideration other than of real love, or to refrain from giving themselves to their beloved for fear of economic consequences. Once such a people appear, they will **care a rap** about what we today think they should do."

Such was the intellectual humility and scientific exactitude of Engels, a man whose self effacing modesty made people describe him merely as the *alter ego* of Marx.

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