V.I. Lenin

MATERIALISM and EMPIRIO-CRITICISM

Critical Comments on a Reactionary Philosophy

(Chapter Five: The Recent Revolution in Natural Science and Philosophical Idealism)

2. "Matter Has Disappeared"

Such, literally, is the expression that may be encountered in the descriptions given by modern physicists of recent discoveries. For instance, L. Houllevigue, in his book *The Evolution of the Sciences,* entitles his chapter on the new theories of matter: "Does Matter Exist?" He says: "The atom dematerialises, matter disappears."[1] To see how easily fundamental philosophical conclusions are drawn from this by the Machians, let us take Valentinov. He writes: "The statement that the scientific explanation of the world can find a firm foundation only in materialism is nothing but a fiction, and what is more, an absurd fiction" (p. 67). He quotes as a destroyer of this absurd fiction Augusto Righi, the well-known Italian physicist, who says that the electron theory "is not so much a theory of electricity as of matter; the new system simply puts electricity in the place of matter." (Augusto Righi, *Die moderne Theorie der physikalischen Erscheinungen*, [*The Modern Theory of Physical Phenomena*], Leipzig, 1905, S. 131. There is a Russian translation.) Having quoted these words (p. 64), Mr. Valentinov exclaims:

"Why does Righi permit himself to commit this offence against sacred matter? Is it perhaps because he is a solipsist, an idealist, a bourgeois criticist, an empirio-monist, or even someone worse?"

This remark, which seems to Mr. Valentinov to annihilate the materialists by its sarcasm, only discloses his virgin innocence on the subject of philosophical materialism. Mr. Valentinov has no suspicion of the *real* connection between philosophical idealism and the "disappearance of matter." The "disappearance of matter" *of which he speaks,* in imitation of the modern physicists, has no relation to the epistemological distinction between materialism and idealism. To make this clear, let us take one of the most consistent and clearest of the Machians, Karl Pearson. For him the physical universe consists of groups of sense-impressions. He illustrates "our conceptual model of the physical universe" by the following diagram, explaining, however, that it takes no account of relative

sizes (*The Grammar of Science*, p. 282):–

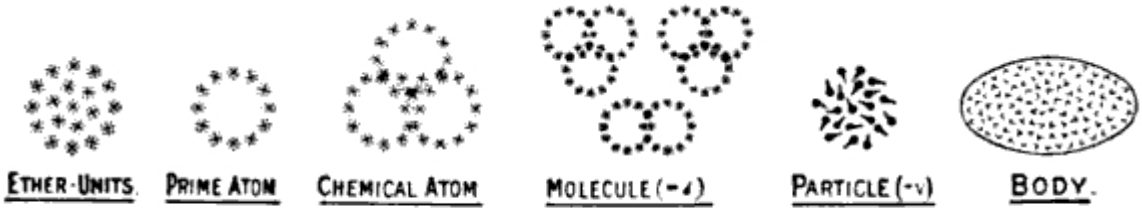

FIG. 21.

In order to simplify his diagram, Karl Pearson entirely omits the question of the relation between ether and electricity, or positive electrons and negative electrons. But that is not important. What is important is that from Pearson's idealist standpoint "bodies" are first regarded as sense-impressions, and then the constitution of these bodies out of particles, particles out of molecules and so forth affects the changes in the model of the physical world, but in no way affects the question of whether bodies are symbols of perceptions, or perceptions images of bodies. Materialism and idealism differ in their respective answers to the question of the *source* of our knowledge and of the relation of knowledge (and of the "mental" in general) to the *physical* world; while the question of the structure of matter, of atoms and electrons, is a question that concerns only this "physical world." When the physicists say that "matter is disappearing," they mean that hitherto science reduced its investigations of the physical world to three ultimate concepts: matter, electricity and ether; whereas now *only* the two latter remain. For it has become possible to reduce matter to electricity; the atom can be explained as resembling an infinitely small solar system, within which negative electrons[3] move around a positive electron[4] with a definite (and, as we have seen, enormously large) velocity. It is consequently possible to reduce the physical world from scores of elements to two or three elements (inasmuch as positive and negative electrons constitute "two essentially distinct kinds of matter," as the physicist Pellat says—Rey, *op. cit.*, pp. 294-95). Hence, natural science leads to the "*unity of matter*" (*ibid.*)[2] —such is the real meaning of the statement regarding the disappearance of matter, its replacement by electricity, etc., which is leading so many people astray. "Matter is disappearing" means that the limit within which we have hitherto known matter is vanishing and that our knowledge is penetrating deeper; properties of matter are likewise disappearing which formerly seemed absolute, immutable, and primary (impenetrability, inertia, mass,[5] etc.) and which are now revealed to be relative and characteristic only of certain states of matter. For the *sole* "property" of matter with whose recognition philosophical materialism is bound up is the property of *being an objective reality,* of existing outside our mind.

The error of Machism in general, as of the Machian new physics, is that it ignores this basis of philosophical materialism and the distinction between metaphysical materialism and dialectical materialism. The recognition of

immutable elements, "of the immutable substance of things," and so forth, is not materialism, but *metaphysical, i.e.,* anti-dialectical, materialism. That is why J. Dietzgen emphasised that the "subject-matter of science is endless," that not only the in finite, but the "smallest atom" is immeasurable, unknowable to the end, *inexhaustible,* "for nature in all her parts has no beginning and no end" *(Kleinere philosophische Schriften,* S. 229-30). That is why Engels gave the example of the discovery of alizarin in coal tar and criticised *mechanical* materialism. In order to present the question in the only correct way, that is, from the dialectical materialist standpoint, we must ask: Do electrons, ether *and so on* exist as objective realities outside the human mind or not? The scientists will also have to answer this question unhesitatingly; and they do invariably answer it in the *affirmative,* just as they unhesitatingly recognise that nature existed prior to man and prior to organic matter. Thus, the question is decided in favour of materialism, for the concept matter, as we already stated, epistemologically implies *nothing but* objective reality existing independently of the human mind and renected by it.

But dialectical materialism insists on the approximate, relative character of every scientific theory of the structure of matter and its properties; it insists on the absence of absolute boundaries in nature, on the transformation of moving matter from one state into another, which is to us apparently irreconcilable with it, and so forth. However bizarre from the standpoint of "common sense" the transformation of imponderable ether into ponderable matter and *vice versa* may appear, however "strange" may seem the absence of any other kind of mass in the electron save electromagnetic mass, however extraordinary may be the fact that the mechanical laws of motion are confined only to a single sphere of natural phenomena and are subordinated to the more profound laws of electromagnetic phenomena, and so forth—all this is but another *corroboration* of dialectical materialism. It is mainly because the physicists did not know dialectics that the new physics strayed into idealism. They combated metaphysical (in Engels', and not the positivist, *i.e.,* Humean, sense of the word) materialism and its one-sided "mechanism," and in so doing threw the baby out with the bath-water. Denying the immutability of the elements and the properties of matter known hitherto, they ended in denying matter, *i.e.,* the objective reality of the physical world. Denying the absolute character of some of the most important and basic laws, they ended in denying all objective law in nature and in declaring that a law of nature is a mere convention, "a limitation of expectation," "a logical necessity," and so forth. Insisting on the approximate and relative character of our knowledge, they ended in denying the object independent of the mind and reflected approximately-correctly and relatively-truthfully by the mind. And so on, and so forth, without end.

The opinions expressed by Bogdanov in 1899 regarding "the immutable essence of things," the opinions of Valentinov and Yushkevich regarding "substance," and so forth—are similar fruits of ignorance of dialectics. From Engels' point of view, the only immutability is the reflection by the human mind (when there is a

human mind) of an external world existing and developing independently of the mind. No other "immutability," no other "essence," no other "absolute substance," in the sense in which these concepts were depicted by the empty professorial philosophy, exist for Marx and Engels. The "essence" of things, or "substance," is *also* relative; it expresses only the degree of profundity of man's knowledge of objects; and while yesterday the profundity of this knowledge did not go beyond the atom, and today does not go beyond the electron and ether, dialectical materialism insists on the temporary, relative, approximate character of all these *milestones* in the knowledge of nature gained by the progressing science of man. The electron is as *inexhaustible* as the atom, nature is infinite, but it infinitely *exists*. And it is this sole categorical, this sole unconditional recognition of nature's *existence* outside the mind and perception of man that distinguishes dialectical materialism from relativist agnosticism and idealism.

Let us cite two examples of the way in which the new physics wavers unconsciously and instinctively between dialectical materialism, which remains unknown to the bourgeois scientists, and "phenomenalism," with its inevitable subjectivist (and, subsequently, directly fideist) deductions.

This same Augusto Righi, from whom Mr. Valentinov was *unable* to get a reply on the question which interested him about materialism, writes in the introduction to his book: "What the electrons, or electrical atoms, really are remains even now a mystery; but in spite of this, the new theory is perhaps destined in time to achieve no small philosophical significance, since it is arriving at entirely new hypotheses regarding the structure of ponderable matter and is striving to reduce all phenomena of the external world to one common origin.

"For the positivist and utilitarian tendencies of our time such an advantage may be of small consequence, and a theory is perhaps regarded primarily as a means of conveniently ordering and summarising facts and as a guide in the search for further phenomena. But while in former times perhaps too much confidence was placed in the faculties of the human mind, and it was considered too easy to grasp the ultimate causes of all things, there is nowadays a tendency to fall into the opposite error" (op. cit., p. 3).

Why does Righi dissociate himself here from the positivist and utilitatian tendencies? Because, while apparently he has no definite philosophical standpoint, he instinctively clings to the reality of the external world and to the recognition that the new theory is not only a "convenience" (Poincaré), not only an "empirio-symbol" (Yushkevich), not only a "harmonising of experience" (Bogdanov), or whatever else they call such subjectivist fancies, but a further step in the cognition of objective reality. Had this physicist been acquainted with *dialectical* materialism, his opinion of the error which is the opposite of the old metaphysical materialism might perhaps have become the starting point of a correct philosophy. But these people's whole environment estranges them from

Marx and Engels and throws them into the embrace of vulgar official philosophy.

Rey too is entirely unfamiliar with dialectics. But he too is compelled to state that among the modern physicists there are those who continue the traditions of "mechanism" *(i.e., materialism)*. The path of "mechanism," says he, is pursued not only by Kirchhoff, Hertz, Boltzmann, Maxwell, Helmholtz and Lord Kelvin. "Pure mechanists, and in some respects more mechanist than anybody else, and representing the culmination *(l'aboutissant)* of mechanism, are those who follow Lorentz and Larmor in formulating an electrical theory of matter and who arrive at a denial of the constancy of mass, declaring it to be a function of motion. *They are all mechanists because they take real motion as their starting point*" (Rey's italics, pp. 290-91).

". . . If, for example, the recent hypotheses of Lorentz, Larmor and Langevin were, thanks to certain experimental confirmation, to obtain a sufficiently stable basis for the systematisation of physics, it would be certain that the laws of present-day mechanics are nothing but a corollary of the laws of electromagnetism: they would constitute a special case of the latter within well-defined limits. Constancy of mass and our principle of inertia would be valid only for moderate velocities of bodies, the term 'moderate' being taken in relation to our senses and to the phenomena which constitute our general experience. A general recasting of mechanics would result, and hence also, a general recasting of the systematisation of physics."

"Would this imply the abandonment of mechanism? By no means. The purely mechanist tradition would still be followed, and mechanism would follow its normal course of development" (p. 295).

"Electronic physics, which should be ranked among the theories of a generally mechanist spirit, tends at present to impose its systematisation on physics. Although the fundamental principles of this electronic physics are not furnished by mechanics but by the experimental data of the theory of electricity, its spirit is mechanistic, because: (1) It uses *figurative (figurés), material* elements to represent physical properties and their laws; it expresses itself in terms of perception. (2) While it no longer regards physical phenomena as particular cases of mechanical phenomena, it regards mechanical phenomena as particular cases of physical phenomena. The laws of mechanics thus retain their *direct continuity* with the laws of physics; and the concepts of mechanics remain concepts of the same order as physico-chemical concepts. In traditional mechanism it was motions copied *(calqués)* from *relatively slow* motions, which, since they alone were known and most directly observable, were taken. . . as a type of all possible motions. *Recent experiments,* on the contrary, show that it is necessary to *extend* our conception of possible motions. Traditional mechanics remains entirely intact, but it now applies only to relatively slow motions. . . . In relation to large velocities, the laws of motion are different. Matter appears to be reduced to electrical particles, the ultimate elements of the atom. . . . (3) Motion,

displacement in space, remains the only figurative *(figuré)* element of physical theory. (4) Finally, what from the standpoint of the general spirit of physics comes before every other consideration is the fact that the conception of physics, its methods, its theories, and their relation to experience remains *absolutely identical* with the conception of mechanism, with the conception of physics held since the Renaissance" (pp. 46-47).

I have given this long quotation from Rey in full because owing to his perpetual anxiety to avoid "materialist metaphysics," it would have been impossible to expound his statements in any other way. But however much both Rey and the physicists of whom he speaks abjure materialism, it is nevertheless beyond question that mechanics was a copy of real motions of moderate velocity, while the new physics is a copy of real motions of enormous velocity. The recognition of theory as a copy, as an approximate copy of objective reality, is materialism. When Rey says that among modern physicists there "is a reaction against the conceptualist [Machian] and energeticist school," and when he ranks the physicists of the electron theory among the representatives of this reaction (p. 46), we could desire no better corroboration of the fact that the struggle is essentially between the materialist and the idealist tendencies. But we must not forget that, apart from the general prejudices against materialism common to all educated philistines, the most outstanding theoreticians are handicapped by a complete ignorance of dialectics.

Notes

[1] L. Houllevigue, *L'évolution des sciences* [*The Evolution of the Sciences],* Paris (A. Collin), 1908, pp. 63, 87, 88; *cf.* his article: "*Les idées des pbysiciens sur la matière*", [*The Physicists' Ideas of Matter]*, in *L'année psycbologique*,[6] 1908. —*Lenin*

[2] *Cf.* Oliver Lodge, *Sur les électrons,* Paris, 1906, p. 159. "The electrical theory of matter," the recognition of electricity as the "fundamental substance," is "an approximate accomplishment of that to what the philosophers strove always, that is, the unity of matter"; *cf.* also Augusto Righi, *Ueber die Struktur der Materie* [*On the Structure of Matter*], Leipzig, 1908; J. J. Thomson, *The Corpuscular Theory of Matter,* London, 1907; P. Langevin, "*La physique des électrons*" [*The Physics of the Electrons*], *Revue générale des sciences*,[7] 1905, pp. 257-76. —*Lenin*

[6] *L'anée psychologique (The Psychological Year)*—the organ of a group of French bourgeois idealist psychologists, published in Paris from 1894. It 'was first edited by Alfred Binet, and afterwards by H. Piéron

[3] The idea of the compound nature of the atom arose at the end of the nineteenth century as a result of the discovery of the periodic system of elements by Mendeleyev, the electromagnetic nature of light, the electron, and the phenomena of radioactivity. Various models of the atom were proposed. Lenin regarded as most probable the planetary model, the idea of which 'was advanced as a guess at the end of the nineteenth century. It was experimentally confirmed by Ernest Rutherford, who investigated the penetration of various substances by alpha-particles (positively charged helium nuclei) and came to the conclusion that the positive charge is concentrated at the centre of the atom, occupying a very small part of the latter's volume. In 1911 he suggested a model of the atom having a positively charged nucleus at the centre, with a mass almost equal to the whole mass of the atom, around which electrons revolve in various orbits, like planets round the sun. This model, however, could not explain the stability of the atom. The first successful attempt to create a theory of atomic structure was based on Rutherford's model and made use of the quantum postulates of Niels Bohr (1913). According to this first quantum theory of the atom, an electron moves in one of the "stable" orbits (corresponding to definite discrete energy values) without radiation; radiation or absorption of a definite portion of energy by the atom occurs only on the passage of the electron from one orbit to another.

Further advances in physics enriched the representation of the structure of the atom. An important part was played here by Louis de Broglie's prediction of wave properties of micro-objects and the subsequent creation of quantum mechanics by Erwin Schrödinger, Werner Heisenberg and others. According to modern ideas the atomic nucleus is surrounded by a cloud of electrons, which occupy various orbits corresponding to definite energy values, and which form with the nucleus a single interconnected system.

The development of physics has shown that the atomic nucleus consists of elementary particles—nucleons (protons and neutrons). New properties of the electron—besides its mass and charge, which were already known in the early twentieth century—have been discovered, including the possibility of its conversion into other particles. In addition to the electron, a number of new elementary particles with diverse properties have been discovered (photons, protons, neutrons, neutrinos, various kinds of mesons and hype Ions). Particles have also been, discovered which possess characteristics equal in magnitude to those of other particles but of opposite sign (so-called anti-particles).

The development of knowledge of the structure of matter has led to man's mastery over nuclear processes and the utilisation of nuclear energy, initiating a new technical revolution of tremendous significance for the future of mankind.

[4] Positive electron— the name given at the turn of the century to the elementary particle bearing a charge of positive electricity. The existence of the positive electron (positron) in the modern sense was predicted in 1928 by the British physicist Paul Dirac; in 1932 the American physicist Carl Anderson

discovered the positron in cosmic rays.

[7] Revue géntrale des sciences purer et appliquées (General Review of Pure and Applied Science) —a journal of natural science published in Paris from 1890. It was founded by Laurence Olivier.

[5] This refers apparently to mechanical mass, which classical p3iysics regarded as an eternal and unchanging property of matter.

1. The Crisis in Modern Physics | 3. Is Motion Without Matter Conceivable?

Contents forward >
Works Index | Volume 14 | Collected Works | L.I.A. Index