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MATERIALISM and EMPIRIO-CRITICISM

Critical Comments on a Reactionary Philosophy

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

5. The Two Trends in Modern Physics, and German Idealism

In 1896, the well-known Kantian idealist Hermann Cohen, with unusually triumphant exultation, wrote an introduction to the fifth edition of the *Geschichte des Materialismus,* the falsified history of materialism written by F. Albert Lange. "Theoretical idealism," exclaims Cohen (p. xxvi), "has already begun to shake the materialism of the natural scientists, and perhaps in only a little while will defeat it completely." Idealism is permeating *(Durchwirkung)* the new physics. "Atomism must give place to dynamism. . . ." "It is a remarkable turn of affairs that research into the chemical problem of substance should have led to a fundamental triumph over the materialist view of matter. Just as Thales performed the first abstraction of the idea of substance, and linked it with speculations on the electron, so the theory of electricity was destined to cause the greatest revolution in the conception of matter and, through the transformation of matter into force, bring about the victory of idealism" (p. xxix).

Hermann Cohen is as clear and definite as James Ward in pointing out the *fundamental* philosophical trends, and does not lose himself (as our Machians do) in petty distinctions between this and that energeticist, symbolist, empirio-criticist, empirio-monist idealism, and so forth. Cohen takes the *fundamental* philosophical trend of the school of physics that is now associated with the names of Mach, Poincaré and others and correctly describes this trend as *idealist*. "The transformation of matter into force" is here for Cohen the most important triumph of idealism, just as it was for the "ghost-seeing" scientists—whom J. Dietzgen exposed in 1869. Electricity is proclaimed a collaborator of idealism, because it has destroyed the old theory of the structure of matter, shattered the atom and discovered new forms of material motion, so unlike the old, so totally uninvestigated and unstudied, so unusual and "miraculous," that it permits nature to be presented as *non-material* (spiritual, mental, psychical) motion. Yesterday's limit to our knowledge of the infinitesimal particles of matter has disappeared, hence—concludes the idealist philosopher—matter has disappeared (but thought remains). Every physicist and every engineer knows that electricity is (material)

motion, but nobody knows clearly *what* is moving, hence—concludes the idealist philosopher—we can dupe the philosophically uneducated with the seductively "economical" proposition: let us *conceive* motion *without matter*. . . .

Hermann Cohen tries to enlist the famous physicist Heinrich Hertz as llis ally. Hertz is ours—he is a Kantian, we sometimes find him admitting the *a priori*, he says. Hertz is ours, he is a Machian—contends the Machian Kleinpeter—for in Hertz we have glimpses of "the same subjectivist view of the nature of our concepts as in the case of Mach."[1] This strange dispute as to *where* Hertz belongs is a good example of how the idealist philosophers seize on the minutest error, the slightest vagueness of expression on the part of renowned scientists in order to justify their refurbished defence of fideism. As a matter of fact, Hertz's philosophical preface to his *Mechanik*[2] displays the usual standpoint of the scientist who has been intimidated by the professorial hue and cry against the "metaphysics" of materialism, but who nevertheless cannot overcome his instinctive conviction of the reality of the external world. This has been acknowledged by Kleinpeter himself, who on the one hand casts to the mass of readers thoroughly false popularly-written pamphlets on the theory of knowledge of *natural science*, in which Mach figures side by side with Hertz, while on the other, in specifically philosophical articles, he admits that "Hertz, as opposed to Mach and Pearson, still clings to the prejudice that all physics can be explained in a mechanistic way,"[3] that he retains the concept of the thing-in-itself and "the usual standpoint of the physicists," and that Hertz still adheres to "a picture of the universe in itself," and so on.[4]

It is interesting to note Hertz's view of energetics. He writes: "If we inquire into the real reason why physics at the present time prefers to express itself in terms of energetics, we may answer that it is because in this way it best avoids talking about things of which it knows very little. . . . Of course, we are now convinced that ponderable matter consists of atoms; and in certain cases we have fairly definite ideas of the magnitude of these atoms and of their motions. But the form of the atoms, their connection, their motions in most cases, all these are entirely hidden from us. . . . So that our conception of atoms is therefore in itself an important and interesting object for further investigations, but is not particularly adapted to serve as a known and secure foundation for mathematical theories" (op. cit., Vol. III, p. 21). Hertz expected that further study of the ether would provide an explanation of the "nature of traditional matter . . . its inertia and gravitational force" (Vol. I, p. 354).

It is evident from this that the possibility of a non-materialist view of energy did not even occur to Hertz. Energetics served the philosophers as an excuse to desert materialism for idealism. The scientist regards energetics as a convenient method of expressing the laws of material motion at a period when, if we may so express it, physicists had left the atom but had not yet arrived at the electron. This period is to a large extent not yet at an end; one hypothesis yields place to another; nothing whatever is known of the positive electron; only three months

ago (June 22, 1908), Jean Becquerel reported to the French Academy of Science that he had succeeded in discovering this "new component part of matter" *(Comptes rendus des séances de l'Académie des Sciences,* p. 1311). How could idealist philosophy refrain from taking advantage of such an opportunity, when "matter" was still being "sought" by the human mind and was therefore no more than a "symbol," etc.

Another German idealist, one far more reactionary than Cohen, Eduard von Hartmann, devoted a whole book to the world outlook of modern physics *(Die Weltanschauung der modernen Physik,* Leipzig, 1902). We are, of course, not interested in the specific arguments of the author in favour of his own variety of idealism. For us it is important only to point out that this idealist notes the same phenomena as Rey, Ward and Cohen. "Modern physics had grown up on a realist basis," says Hartmann, "and it was only the Neo-Kantian and agnostic movement of our own time that led it to re-interpret its data in an idealist spirit" (p. 218). According to Hartmann, three epistemological systems constitute the basis of modern physics—hylo-kinetics (from the Greek *hyle*—matter, and *kinesis*—motion—*i.e.,* the recognition of physical phenomena as matter in motion), energetics, and dynamism *(i.e.,* the recognition of force without substance). Of course, the idealist Hartmann favours "dynamism," from which he draws the conclusion that the laws of nature are world-thought, in a word, he "substitutes" the psychical for physical nature. But he is forced to admit that hylo-kinetics has the majority of physicists on its side, that it is the system that "is most frequently employed" (p. 190), that its serious defect is "materialism and atheism, which threaten from pure hylo-kinetics" (p. 189). This author quite justly regards energetics as an intermediary system and calls it agnosticism (p. 136). Of course, it is an "ally of pure dynamism, for it dethrones substance" (pp. vi, 192), but Hartmann dislikes its agnosticism as a form of "Anglomania," which is incompatible with the genuine idealism of a true-German reactionary.

It is highly instructive to see how this irreconcilable partisan idealist (non-partisans in philosophy are just as hopelessly thick-headed as they are in politics) explains to the physicists what it means to follow one epistemological trend or another. "Only a very few of the physicists who follow this fashion," writes Hartmann in reference to the idealist interpretation of the latest results in physics, "realise the full scope and implications of such an interpretation. They have failed to observe that physics with its specific laws has retained significance only in so far as, despite its idealism, it has adhered to *realistic* basic propositions, *viz.*, the existence of things-in-themselves, their real mutability in time, real causality. . . . Only by granting these realistic premises (the transcendental validity of causality, time and three-dimensional space), *i.e.,* only on the condition that nature, of whose laws physics speaks, coincides with a . . . realm of things-in themselves, can one speak of natural laws as distinct from psychological laws. Only if natural laws operate in a realm independent of our mind can they serve as an explanation of the fact that the logically necessary effects of our images are always images of the natural-historically necessary

effects of the unknown which they reflect or symbolise in our consciousness" (pp. 218-19).

Hartmann rightly feels that the idealism of the new physics is nothing but a *fashion,* and not a serious philosophical turn away from natural-historical materialism; and he, therefore, correctly explains to the physicists that in order to transform the "fashion" into consistent, integral philosophical idealism it is necessary radically to modify the doctrine of the objective reality of time, space, causality and natural law. We cannot regard only atoms, electrons and ether as mere symbols, as a mere "working hypothesis": time, space, the laws of nature and the whole external world must also be proclaimed a "working hypothesis." Either materialism, or the universal substitution of the psychical for the whole of physical nature; those anxious to confound the two are legion, but we and Bogdanov are not of their number.

Among the German physicists, Ludwig Boltzmann, who died in 1906, systematically combated the Machian tendency. We have already pointed out that as against those who were "carried away by the new epistemological dogmas" he simply and clearly reduced Machism to solipsism (see above, Chap. I, § 6). Boltzmann, of course, was afraid to call himself a materialist and even explicitly stated that he did not deny the existence of God.[5] But his theory of knowledge is essentially materialistic, and expresses—as is admitted by S. Günther,[6] the historian of natural science in the nineteenth century—the views of the majority of scientists. "We know," says Boltzmann, "of the existence of all things solely from the impressions they make on our senses" (op. cit., p. 29). Theory is an "image" (or copy) of nature, of the external world (p. 77). To those who say that matter is only a complex of sense-perceptions, Boltzmann points out that in that case other people are only the sensations of the speaker (p. 168). These "ideologues," as Boltzmann sometimes calls the philosophical idealists, present us with a "subjective picture of the world" (p. 176), whereas the author prefers a "simpler objective picture of the world." "The idealist compares the assertion that matter exists as well as our sensations with the child's opinion that a stone which is beaten experiences pain. The realist compares the assertion that one cannot conceive how the mental can be formed from the material, or even from the play of atoms, with the opinion of an uneducated person who asserts that the distance between the sun and the earth cannot be twenty million miles, for he cannot conceive it" (p. 186). Boltzmann does not deny that the ideal of science is to present mind and volition as "complex actions of particles of matter" (p. 396).

L. Boltzmann frequently polemicised against Ostwald's energetics from the standpoint of a physicist, and argued that Ostwald could neither disprove nor eliminate the formula of kinetic energy (half the mass multiplied by the square of velocity) and that he was revolving in a vicious circle by first deducing energy from mass (by accepting the formula of kinetic energy) and then defining mass as energy (pp. 112, 139). This reminds me of Bogdanov's paraphrase of Mach in the third book of his *Empirio-Monism*. "In science," writes Bogdanov in

reference to Mach's *Mechanik*,[111] "the concept matter is reduced to the coefficient of mass as it appears in the equations of mechanics, upon accurate analysis, how ever, the coefficient of mass proves to be the reciprocal of the acceleration when two physical body-complexes interact" (p. 146). It is evident that if a certain *body* is taken as a unit, the motion (mechanical) of all other bodies can be expressed as a mere relation of acceleration. But this does not at all mean that "bodies" *(i.e.,* matter) disappear or cease to exist independently of our mind. When the whole world is reduced to the movement of electrons, it will be possible to eliminate the electron from all equations, because it will be everywhere assumed, and the correlation between groups or aggregates of electrons will reduce itself to their mutual acceleration, if the forms of motion prove to be as simple as those of mechanics.

Combating the "phenomenalist" physics of Mach and Co., Boltzmann maintained that "those who believe atomism to have been eliminated by differential equations, cannot see the wood for the trees" (p. 144). "If we do not wish to entertain illusions as to the significance of a differential equation . . . we cannot doubt that this picture of the world (expressed in differential equations) must again by its nature be an atomic one, *i.e.,* an instruction that the changes in time of a vast quantity of things arranged in three-dimensional space must be thought of in accordance with definite rules. The things can, of course, be similar or dissimilar, unchangeable or changeable," etc. (p. 156). "If we are perfectly clear," said Boltzmann in an address delivered to the Congress of Scientists held in Munich in 1899, "that the phenomenalists cloaked in differential equations likewise base themselves on atom-like discrete units *(Einzelwesen)* which they have to picture as possessing now certain properties now others for each group of phenomena, the need for a simplified, uniform atomism will soon again be felt" (p. 223). The electron theory "is developing into an atomic theory of electricity as a whole" (p. 357). The unity of nature is revealed in the "astonishing analogy" between the differential equations of the various realms of phenomena. "The same equations can be regarded as solving the problems of hydro-dynamics and of the theory of potentials. The theory of vortices in fluids and the theory of friction in gases *(Gasreibung)* reveal a most astonishing analogy to the theory of electromagnetism, etc." (p. 7). Those who accept "the theory of universal substitution" cannot escape the question: Who was it that thought of "substituting" physical nature so uniformly?

As if in answer to those who brush aside "the physicist of the old school," Boltzmann relates in detail how certain specialists in "physical chemistry" are adopting an epistemological position contrary to that of Machism. Vaubel, the author of "one of the best" comprehensive works of 1903 (according to Boltzmann), "takes up a definitely hostile attitude towards the so-called phenomenalism so often recommended today" (p. 381). "He tries rather to obtain as concrete and clear an idea as possible of the nature of atoms and molecules and of the forces and agencies acting between them, and this idea he attempts to bring into conformity with the most recent experiments in this field [ions,

electrons, radium, Zeeman effect, etc.]. . . . The author strictly adheres to the dualism of matter and energy,[7] which have this in common that each has a special law of conservation. In regard to matter, the author also holds fast to the dualism between ponderable matter and ether, yet regards the latter as material in the strictest sense" (p. 381). In the second volume of his work (theory of electricity) the author "from the very outset takes the view that the phenomena of electricity are determined by the interaction and movement of atom-like entities, the electrons" (p. 383).

Hence, we find that what the spiritualist James Ward admitted to be true of England applies also to Germany, namely, that the physicists of the realistic school systematise the facts and discoveries of recent years no less successfully than the physicists of the symbolist school and that the essential difference between them consists "*only*" in their epistemological points of view.[8]

Notes

[1] *Archiv für systematische Philosophie,* Bd. V, 1898-99, S. 169-70. —*Lenin*

[2] Heinrich Hertz, *Gesammelte Werke,* Bd. III, Leipzig, 1894, esp. S. 1, 2, 49. —*Lenin*

[3] *Kantstudien,* VIII, Band, 1903, S. 309. —*Lenin*

[4] *The Monist,* Vol. XVI, 1906, No. 2, p. 164; an article on Mach's "Monism." —*Lenin*

[5] Ludwig Boltzmann, *Populäre Schriften,* Leipzig, 1905, S. 187. —*Lenin*

[6] Siegmund Günther, *Geschichte der anorganischen Naturwissenschaften im 19. Jahrhnndert* [*History of the Inorganic Sciences in the Nineteenth Century*], Berlin, 1901, S. 942 und 941. —*Lenin*

[7] Boltzmann wishes to say that the author does not attempt to conceive motion without matter. To speak of dualism here is ridiculous. Philosophical monism and dualism consist respectively in a consistent or inconsistent adherence to materialism or idealism. —*Lenin*

[8] The work of Erich Becher, *Philosophical Premises of the Exact Sciences (Philosophische Votaussetzungen der exakten Naturwissenschaften,* Leipzig, 1907), with which I became acquainted only after my book had been completed, confirms what has been said in this paragraph. Holdin, closest of all to the epistemological point of view of Helmholtz and Boltzmann, that is, to a "shamefaced" and incompletely thought-out materialism, the author devotes his work to a defence and interpretation of the fundamental premises of physics and

chemistry. This defence naturally becomes converted into a fight against the fashionable but increasingly-resisted Machian trend in physics *(cf.* p. 91, etc.). E. Becher correctly characterises this tendency as "*subjective positivism*" (p. iii) and reduces the central point of his objection to it to a proof of the "hypothesis" of the external world (Chapters II-VII), to a proof of its "existence independently of human perceptions" *(vom Wahrgenommenawerden unabhängige Existenz)*. The denial of this "hypothesis" by the Machians frequently leads the latter to *solipsism* (pp. 78-82, etc.). "Mach's view that sensations and complexes of sensations, and not the external world" (p. 138), are the only subject matter of science, Becher calls "sensationalist monism" *(Empfindungsmonismus)* and classes it with the "purely conscientialistic tendencies." This clumsy and absurd term is constructed from the Latin word *conscientia*—consciousness, and means nothing but philosophical idealism *(cf.* p. 156). In the last two chapters of the book E. Becher quite skilfully compares the old mechanical theory with the new electrical theory of matter and world-picture (the "kinetico-elastic," as the author puts it, with the "kinetico-electric" conception of nature). The latter theory, based on the electron theory, is a step forward in knowledge of the unity of the world; according to this theory the "elements of the material world are electrical charges" *(Ladungen,* p. 223). "Every purely kinetic conception of nature knows nothing save a certain number of moving objects, whether they are called electrons or something else. The state of motion of these objects in successive time intervals is consistently determined by their position and state of motion in the preceding time interval" (p. 225). The chief defect of Becher's book is his absolute ignorance of dialectical materialism. This ignorance frequently leads him into confusion and absurdity, on which it is impossible to dwell here.
—Lenin

4. The Two Trends in Modern Physics and English Spiritualism | 6. The Two Trends in Modern Physics and French Fideism

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