

SCHELLING AND THE DUAL NATURE OF LIGHT*

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Resumo: Neste trabalho procuramos mostrar como Schelling, baseado na dialética especulativa, antecipou, tal como o fizera em relação a inúmeros outros fenômenos físicos, uma importante teoria sobre a natureza da luz, a qual o físico Louis de Broglie demonstrou ser verdadeira apenas 150 anos mais tarde.

Palavras-chave: Schelling, De Broglie, luz.

Schelling's philosophy of nature was the first and, at the same time, the last successful attempt to give answers to certain important questions of Physics, which were experimentally proved many years later. It is true that Hegel dealt with these questions in the second part of his *Enzyklopädie*, but when we look well into his answers and compare it to those of the young Schelling, we can easily conclude that the author of the *Von der Weltseele* outdid Hegel in originality and intelligence. Thus, we can be certain that Schelling's answers are original contributions and not a mere speculation about conclusions of other thinkers and scientists. The lectures from *Ideen zu einer Philosophie der Natur*, *Von der Weltseele* and *Erster Entwurf eines Systems der Naturphilosophie* presented very detailed studies about certain physical phenomena and conclusions which the physicists of that time hadn't reached.¹

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The connection between magnetism and electricity was one of these original conclusions. Schelling was the first to affirm that both are the manifestation of the same phenomenon. He made this affirmation 25 years before Oersted demonstration that a magnetic needle could be diverted by an electrical current and 35 years before Faraday prove the contrary, namely, that an electrical current could arise by the movement of a magnet and, finally, 75 years before Maxwell reconstruction of the two experiments of Oersted and Faraday together and his explanation of the experiments with his famous equations, which offered a theory of the electromagnetism. When Schelling wrote: “We have to believe that the *electrical* polarity is produced in a body by *the same law* according to which the magnetic one is produced” (SCHELLING, 1997, Part I, Vol. 2, p.478), he established the basis of the previously mentioned theory, which says that the speed of the electric magnetism wave is the same as that of the light and, in addition to this, that the light’s wave is of electric-magnetic nature.

In this aspect, it is very important to remark that Schelling was the first thinker to make an association between electricity, magnetism and light. We can then show how such an association is decisive in Schelling’s conception of nature and thus, how its philosophy was built on the basis of it.

Since *Vom Ich als Prinzip der Philosophie* and *Über die Möglichkeit einer Form der Philosophie überhaupt*, Schelling spoke about the necessity to start his Philosophy with the idea of an absolute unity, an absolute identity or an originary reality which was given by the *Ich* as an unconditional principle and a product of an intellectual intuition. But, at the same time, it was necessary for Schelling to accept

another principle, namely, the principle of the conditionality, which was now given by one too original *Nicht-Ich*. Accordingly, Schelling claimed not only a mere Identity but also a real substance for the world. In this sense the superiority of the principle of the *Ich* is only ideal, because in reality the unity demands necessarily the plurality. The unity of the *Ich* comes before only because it means activity, dynamism, which requires interaction and so matter. In this dialectical theory there is not space for one opposition between activity and passivity, infinity and finite. Schelling's thought is pregnant with influences of Spinoza and Leibniz in this respect. In addition to this, Schelling was influenced by Fichte who regarded activity as an eternal flow, which is only apparently broken, since a finite product always keeps action within itself.

But it is not our intention here to describe in detail Schelling's argument in relation to this dialectic. We move on to the new phase of Schelling's work which begins with *Ideen zu einer Philosophie der Natur*, where such dialectic is presented not as a logical but as an empirical question. In this context the kernel of the discussion turns around nature itself. Now the identity is the matter and the matter is not understood as a kind of intelligible *material prima*, like in Aristotle, but it expresses already the unity of the infinite with the finite (SCHELLING, 1997, Part I, Vol. 2, p.360). A connection between these two extremes must be thought because each of them cannot reach the other by itself. For Schelling, the role of this connection is something assumed by the gravity which is regarded as original and necessary. Such original character lead us to conclude that this concept cannot be understood only in terms of an external force, as Newton understood it, but according to Einstein's

theory of general relativity, which described gravity as belonging to the intrinsic nature of the matter. It is therefore correct to say that both matter and gravity can be seen as the eternal *Band* of all things.

This is the reason why Schelling adopted the idea of an original duality or duplicity in nature. Schelling says: “Where there are appearances, there are opposite forces. The *doctrine of nature* presupposes thus a *universal duplicity* as an immediate principle and a *universal unity* of the matter so as to be able to make sense of that duplicity. Neither the principle of the absolute difference nor the absolute identity is the truth; truth lies in the *union of both*”². (SCHELLING, 1997, Part I, Vol. 2, p.390)

Such dualism or polarity is for Schelling thus the first principle of a philosophical doctrine about nature (SCHELLING, 1997, Part I, Vol. 2, p.476). Schelling calls it a “universal law of the world” (SCHELLING, 1997, Part I, Vol. 2, p.489). So, the development of all forms of nature, from the inorganic to the organic, is an expression of this dualism (SCHELLING, 1997, Vol. 2, p.490-507). We can find it, for example, in matter, in light, in magnetism, in electricity, in chemical process and in organic bodies.³

When Schelling affirms that all in nature is animated he intends exactly to stress the effects of this dualism. What is the first manifestation of this animation? For Schelling it is magnetism, “a kind of transportation from the unity into the multiplicity, from the concept into the difference” (SCHELLING, 1997, Part I, Vol. 2, p.164). Due to this primary character of the magnetism, Schelling backs the idea that we can find its causes acting continuously in all body and taking place in all phenomena. He said: “Since magnetism is a universal force of nature, there is no body in

the world that is absolutely not magnetic, as well as there is no body that is absolutely transparent or not transparent, hot or cold” (SCHELLING, 1997, Part I, Vol. 2, p.485) Such elemental force is internal and belongs to the structure of the matter itself and it is thus more originary than that of electricity. The electric force stays on the superficies of the body and it is conducted through it without modifying the body itself because this is a communication (*Mitteilung*), while the magnet appears in another body through a repartition (*Verteilung*) or vibration (*Erregung*). Magnetism is for nature in general like the sensibility is for an organic body (SCHELLING, 1977, Part I, Vol. 3, p.257). Sensibility has exactly the same duality as that one which happens in the magnetism, although under another quality or form. The sensibility is only the point of arrival of a progression which begins with magnetic polarity goes on in electrical phenomena and evolves towards the chemical, finally appearing in the organic structures.

Therefore magnetism is the germ of an infinite evolution of the universe (SCHELLING, 1977, Part I, Vol. 3, p.258). A germ which develops through repartition into all products and happens in the inner of the particular object. The question that emerges now is how such a dynamic process can build up something stable. The original repartition engenders opposite forces, mere heterogeneity. But opposite forces tend to reach and keep a balance. Schelling’s dialectic is also clear here: the heterogeneity reaches the homogeneity because there is not an absolute heterogeneity, an absolute indifference or absolute rest. The balance is homogeneity, but not an absolute one. So homogeneity is only a state of indifference and heterogeneity, only a state of difference.

After having spoken about this universal polarity and knowing that this polarity is synonym for magnetism, we are now able to start the discussion about the phenomenon of the light. For Schelling “the light is the first and positive cause of universal polarity” (SCHELLING, 1997, Part I, Vol. 2, p.397). That is, light is an original manifestation of gravity. It belongs to that which the philosopher called “the identity of the all existing things”. The light and its dualism are only possible because it is the first quality of matter, the first determined material being or in Hegel’s expression (HEGEL, 1991. p.232-233) the absolutely light, the material ideality⁴.

So when gravity is the *One* (the original unity), the light is the substance itself, otherwise there would be no difference and consequently no world. Reality, all kind of things of nature, can be seen as a connection between gravity and light. The darkness of gravity and the brightness of the light produce together the beautiful appearance of life, said Schelling in a poetical phrasing (SCHELLING, 1997, Part I, Vol. 2, p.369). Gravity is the unity in the multiplicity, and the eternity in the temporal. So it is a force that acts to limit space, to remain as something connected. In this sense it is the control of the rigid, the fixed. Light, on the contrary, tends to unfold, to overcome the opposed force and go away and to stay around the universe in each object like a flower that blooms.

What was then for Schelling light’s composition? At first he said that light moves so fast and with such a strong force that someone can doubt its materiality and deny its inertial character. But although it moves in such fast speed, it is neither more nor less inertial than any other kind of matter. I.e., it is a carrier of mass. An absolute rest is for

Schelling an absurd. All rest is only apparent, that is, relative. What induces the speed of light to be perceived as finite is the force attraction which is present in all nature. Following the diagram of the conflict between the two primitive forces (attraction and repulsion) proposed by Kant (1998, p.47-99), Schelling presumed that, if affected only by repulsive force, light and all other kind of matter would travel with infinite speed, that being an impossibility. On the contrary: if affected only by attractive force, it would remain in an absolute rest, the concentration of the matter in only one point which would be the empire of nothing. Schelling said that “it is possible to consider gravitation in matter and in light as *disappearing*, but never as completely *eliminated*” (SCHELLING, 1997, Part I, Vol. 2, p.385).

If the materiality of the light is assumed by Schelling, what kind of substance had he in mind? The explanation for that is very simple: Schelling believed in the hypothesis of a universal medium called ether, which was regarded at that time and even beyond Schelling as a very logical conception. But the ether had to be accepted by Schelling not only to explain the existence of movement of bodies but also as the source of all sort of matter, such as air, water and light.

How did the light appear? For Schelling it appeared from the atmospheric air which he regarded as a phenomenon that is original and simultaneous to light, and present in all parts of the universe, but fundamental in air's composition for the explanation of the light is oxygen. This substance is intimately associated to the phenomenon of burning. The basic aspect of this explanation is the chemical experiment of the fire which produces light. This experiment led Schelling to conclude that the connection

between oxygen and light is an all-encompassing phenomenon of nature. The oxygen is the real source of light, its substance, or matter. But it is the cause not only of the light and the heat, but also of the electricity⁵. The heat has its origin in the friction which pressures the air and causes the decomposition of the oxygen. The electricity starts by such decomposition. The difference between heat and electricity is the following: in the first phenomenon occurs total decomposition of the substance into two entirely different matters, namely, positive oxygen (+O) and negative oxygen (-O) in which many other real oppositions or polarities are possible. In the second one there is only a partial decomposition of the oxygen where an effective dialectic opposition can arise (SCHELLING, 1997, Part I, Vol. 2, p.440). The body that has more affinity to the (-O), i.e. the one that attracts it more, is negative electricity; the body that repels the (-O) and has more affinity to (+O) is positive electricity. That is, the electric quality of the body, based on which it is positive or negative, depends upon its affinity to either (+O) or to (-O). This explains why the body which is more prone to melt and burn is electrically negative and why the body that is transparent and not burns is electrically positive. In the first case the body repels (-O) and in the second, it attracts (+O). Due to the fact that metal is a very good electrical conductor : it conducts electricity not only because it is able to burn, i.e. to attract (-O), but also because it is very difficult to melt, what makes it impermeable to (+O). Thus, when two bodies are in friction, one against the other, the positive and the negative electricity are distributed, consequently an original heterogeneity appears and then they become electrified. So the general medium of electric stimulation is an irregular heating, which, when occurs

through the friction between two bodies, leads the less heated to get a positive electricity and the more heated, a negative one. In this sense the heating is for Schelling the general cause that triggers and maintains all dualism, i.e., the positive and the negative principles of the world. There are four possibilities to explain the origin of such dualism. The two first possibilities happen, either when originally heterogeneous bodies are heated by an equal cause or when originally homogeneous bodies are heated by an unequal cause. The two last possibilities happen only in one body where dualism arises either when there is an original heterogeneity or when the body is heated in an irregular way (SCHELLING, 1997, Part I, Vol. 2, p.478). The cause of electricity is the same as that of magnetism. Schelling remarked that irregular heating of iron and other substances leads to magnetic properties. This amounts to say that magnetic polarity is triggered in accordance to the same law as electrical one, and there is no doubt that both occur through the same mechanism (SCHELLING, 1997, Part I, Vol. 2, p.480). It is apposite to note that this mechanism is the same as that of the light. The partial character of the decomposition of electricity is what leads to the existence of this phenomenon. Both electric fluids are only changed lights, remarked Schelling. “It has its development in keeping with the dynamical polarity that shows up the decomposition of oxygen (which, on its side, arises by the action of the sun and other heavenly bodies)”.

It is very important to explain how the movement of the light is possible. Schelling assumed the idea of ether proposed by Euler. For Euler, without an elastic and not qualitative medium we couldn't consider the possibility of the movement of bodies in the space⁶. Schelling used this

idea to explain the movement of light. For him, we have to accept the existence of this especial atmosphere circling all bodies and guarantying that light penetrate into all space and averting so the absurdity of one absolute hiatus or absolute empty. This explanation is close to the one Christian Huygens has given to same problem, but with a difference: Huygens didn't assume the materiality of light. He thought that the nature of light's wave was related to the transmission of energy and not to the formation of a substance⁷. Euler, in his attempt to combat Newton's force of gravity (because it is one kind of force that one can not know how it appears) and to show that the attraction's force or the phenomenon of free fall were explained by the action of the ether, considered the solution of the problem of transmission of matter as the most important one. This is why Euler was the most important reference for Schelling in his attempt to solve the question of the movement of light.

So what was the definite position of Schelling about the existence of the light? For him, Newton's view that light is composed by material particles is insufficient to explain its movement. This explanation need to be complemented by the explanation of Euler, although it was also a mechanical explanation. Schelling said: "I ask if we couldn't unify Newton's and Euler's theory of light. What do actually the followers of Newton want? A matter which is able to the have its own relations within bodies so its own effects, too. What does Euler want, he who agrees with him? - That the light is a mere phenomenon of a medium that moves and vibrates [...] so we have what Newton wants, namely light's own matter (which can even be expressed in chemical terms) and what Euler wants, namely, the propagation of light through a mere vibration of a decomposed medium.

As far as I know, both Newton's and Euler's followers admit that these theories have their own difficulties, because one excludes the other. Isn't it better to consider these opinions as reciprocal complementations and have them united in one hypothesis instead of seeing them as opposite opinion?" (SCHELLING, 1997, Part I, Vol. 2, p.387)

Like Huygens Euler hadn't spoken about "wave" but about "vibration" in ether. This is not a problem because Euler proposed that there is no difference between the concept of wave and that of vibration. This becomes evident with subsequent Louis de Broglie's hypothesis concerning the association between light's corpuscles and vibration (and thus between this and waves). Author of the *double nature* of light, De Broglie proposed the idea that the quantum states of an atom are defined by means of the harmonic vibrations of the electromagnetic waves thanks to the force that is exerted by the nucleon. Such an association was present not only in the phenomenon of light but also in all things with a mass. For De Broglie, the internal Energy ($=mc^2$) of a physical object corresponds to the oscillatory phenomenon with a determined frequency ν , combining thus the squares of Einstein and of Planck $E = mc^2 = h \nu$ ($h =$ Planks constant)⁸.

It is clear that the content of the De Broglie's answer for this problem is superior in quality, because the scientific knowledge achieved one century after Schelling is remarkably superior. Schelling had no representation of the micro structure of matter that included entities like electrons, protons and the atomic model like that of Rutherford/Bohr. The theoretical resources available to ground the idea of polarity (- and + O) were very elementary. But

there is no doubt that, despite this lack of resources, Schelling was following the right lead. It's absolutely fantastic that he could anticipate the theory of De Broglie with the help of his dialectical conception of the world. The program of his speculative Physics led actually to good results, such as those concerning the phenomenon of light⁹.

Abstract: This essay is purported to show that - based on a dialectical speculation - Schelling anticipated, as he did in relation to many other phenomena of Physics, a very important theory about the nature of light, which the physicist Louis de Broglie proved to be true only one hundred and fifty years later.

Key words: Schelling, De Broglie, light.

NOTES

- 1 About the stage of the natural science at Schelling's time and his capacity to anticipate many conclusions, see HEUSER-KESSLER, M.-Luise (1986).
- 2 It's important to note here, how this philosophical position has no relation to Hegel's criticism that Schelling's thoughts were dominated by the principle of the identity, which was like the night in which all cows were black. Especially because of the fact, that for Schelling, philosophy was philosophy of nature. So we can say that the problem of the beginning arise in Schelling's exactly how in Hegel's thought. The characteristic of the identity is also present in the initial concept of *Sein*. Hegel's attempt to demonstrate that such concept cannot be adopted in opposition to the *Nicht* (what leads to assume the concept of *Werden*), is the same Schelling's attempt to show that identity cannot be assumed without duality (and this is also the expression of *Werden*). And due to the fact that to understand the nature in itself was for Schelling the most important philosophical program and not, like in Hegel, who regarded the nature as the 'other' of the Idea subordi-

nated to the Ghost, Schelling could, in our opinion, express better the force of the concept of a dynamic.

- 3 This, then, leads Schelling to admit the idea that there is an organization of the nature and that the organic is previous to the mechanical. This means that there is one kind of evolution of nature, but without making concession to the possibility of the existence of living forces acting on it. When he speaks about an evolution in nature, he is addressing the issue in a transcendental and not in an empirical meaning. Schelling wished to adopt the program that Kant presented in the *Faculty of Judge* of Kant, or Third Critique, pursuing the solution for the organic and for the system as whole, but, now, with the demand of the *Critique of the Pure Reason*, namely, that not only the mechanical phenomena must be construed (as Kant thought), but also all other sorts of them, including the organic (what, for Kant, was absolutely impossible). One of the most important presentations and discussions about the connection between magnetism, electricity and chemical process as a continuum happening in: Schelling's *Philosophy of the Nature* is the article of MOISO, F. (1986. p.54-87).
- 4 In the *Ideen zu einer Philosophie der Natur* Schelling spoken about a original relation between matter and light, what, how we have already seen, is similar to the relation between gravity and light: "The light is the same as matter, matter is the same as light, matter conceived as real and the light conceived as ideal. The matter is the real act of filling of the space as it is the filled space itself. The light is not the filling of the space itself, nor the filled space, but only the ideal reconstruction of that filling according the three dimensions" (p.107).
- 5 A detailed text about the phenomenon of the electricity in the sequence of the Works *Ideen zu einer Philosophie der Natur, Von der Weltseele and Erster Entwurf eines Systems der Naturphilosophie* see MOISO, F. (1985. p.59-97).
- 6 See EULER (1986).
- 7 See HUYGENS (1890).

- 8 Regarding De Broglie's theory of the dual nature of light, see KRAGH, H. (1999) and ROSA, P.S. (2004).
- 9 About the role of this Schelling's dialectical and speculative conception, see MEYER, R. W. (1985, p.129-156) and SCHMIED-KOWARZIK, W. (1996).

REFERENCES

EULER, L. *Briefe an eine deutsche Prinzessin über verschiedene Gegenstände aus der Physik und Philosophie*. New edition by SEXL, R. U. and MEYENN, K. v. Vol. 3, Braunschweig – Wiesbaden: Edition Vieweg, 1986.

HEGEL, G. W. F. Naturphilosophie. In: NICOLIN, Friedhelm and PÖGGELER, Otto (eds.). *Enzyklopädie der philosophischen Wissenschaften im Grundrisse (1830)*. Hamburg: Felix Meiner Verlag, 1991.

HEUSER-KESSLER, M.-Luise. *Die Produktivität der Natur. Schellings Naturphilosophie und das neue Paradigma der Selbstorganisation in den Naturwissenschaften*. Berlin: Duncker & Humboldt, 1986.

HUYGENS, C. Abhandlung über das Licht (1678). In: LOMMEL, E. (ed.). *Oswalds Klassiker der exakten Wissenschaften, N^o 20*. Leipzig: Verlag von Wilhelm Engelmann, 1890.

KANT, I. Metaphysische Anfangsgründe der Naturwissenschaft. In: WEISCHEDEL, Wilhelm (ed.). *Werke in sechs Bänden, Band V*, Darmstadt: Wissenschaftliche Buchgesellschaft, 1998, paginação.

KRAGH, H. *Quantum generations: A history of physics in the twentieth century*. Princeton: University Press, 1999.

MEYER, R. W. Zum Begriff der spekulativen Physik bei Schelling. In: HECKMANN, Reinhard, KRINGS, Hermann and MEYER, Rudolf W. (eds.). *Natur und Subjektivität. Zur Auseinandersetzung mit der Naturphilosophie des jungen Schelling*, Stuttgart-Bad Cannstatt: Friedrich Frommann Verlag, 1985.

MOISO, F. Schellings Elektrizitätslehre 1797-1799. In: HECKMANN, Reinhard, KRINGS, Hermann and MEYER, Rudolf W. (eds.). *Natur und Subjektivität, Zur Auseinandersetzung mit der Naturphilosophie des jungen Schelling*. Stuttgart-Bad Cannstatt: Friedrich Frommann Verlag, 1985.

_____. Die Hegelsche Theorie der Physik und der Chemie in ihrer Beziehung zu Schellings Naturphilosophie. In: HORSTMANN, Rolf-Peter and PETRY, Michael John (eds.). *Hegels Philosophie der Natur. Beziehungen zwischen empirischer und spekulativer Naturerkenntnis*. Stuttgart: Ernst Klett Verlage GmbH u. Co. KG, 1986.

ROSA, P. S. *Louis de Broglie e as ondas de matéria*. 2004, 80 pages, Dissertação de Mestrado. Campinas: Instituto de Física da Unicamp.

SCHELLING, F. W. J. Ideen zu einer Philosophie der Natur als Einleitung in das Studium dieser Wissenschaft. In: HAHN, Elke (ed.). *Schelling Werke CD-ROM. Part I, Vol. 2*, Berlin: Total Verlag, 1997.

_____. Von der Weltseele, eine Hypothese der höheren Physik zur Erklärung über das

Verhältniß des Realen und Idealen in der Natur'. In: HAHN, Elke (ed.). *Schelling Werke CD-ROM. Part I, Vol. 2*, Berlin: Total Verlag, 1997.

_____. Erster Entwurf eines Systems der Naturphilosophie. In: HAHN, Elke (ed.). *Schelling Werke CD-ROM. Part I, Vol. 3*, Berlin: Total Verlag, 1977.

SCHMIED-KOWARZIK, W. *Von der wirklichen, von der seyenden Natur'. Schellings Ringen um eine Naturphilosophie in Auseinandersetzung mit Kant, Fichte und Hegel*. Ed. by EHRHARDT, Walter E., Stuttgart-Bad Cannstatt: Friedrich Frommann Verlag, 1996.