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Magnetic attraction as interpreted by Valerianus Magni

Valerianus Magni (1586–1661) was an eminent seventeenth-century protagonist of scientific philosophy trying to solve problems through experimenting. Owing to the precious study by Mieczysław Subotowicz we know well nowadays that in this respect he found approval for his experiment showing the existence of vacuum in nature; influenced by Galileus' works he carried it out by himself in Warsaw in 1647 [1]. Through observation and experiments he also tried to solve other problems: the existence of atoms, the nature of light and heat and particularly the phenomenon of magnetic attraction. Those attempts were not noticed by historians of science because his treatises concerning those subjects remained as manuscripts since he was arrested on February one, 1661, and the print of his work „Opus philosophicum” which was to include them was interrupted: only a few incomplete copies appeared [2].

1. Empirical data on magnet

Magni's views on magnetic attraction were formed under the influence of the English scientist and physician, William Gilbert from Colchester (1544–1603), who was a classical author in this field. Magni considered him his master in scientific research and estimated him as much as Nicolaus Copernicus and Galileus [3]. It should be noticed that he not only quoted his principal work but really drew from it his knowledge on magnet and owing to him he was confirmed in his Platonic spiritualism, anti-Aristotelism and Copernican heliocentrism [4].

It should be noticed in the first place that Magni's interpretation of the magnet is his own and original; it is the consistent adaptation of his own metaphysical theory of dynamic and motionless beings to the philosophy of nature. Thus it is a purely philosophical interpretation. In his reasoning Magni starts from empirical data which he considers to be directly self-evident premisses; they are minor premisses in his syllogism. Then he applies the thesis of his metaphysics to the major premisses and comes to conclusions on the actual cause of magnetic attraction.

Determining empirical data Magni noted that one could observe the phenomenon of magnetic attraction using a special stone coming from iron mines. It is commonly called magnet. It attracts iron. When placed on a needle its position is conformable with the poles of the „daily motion” [5].

The magnetic stone consists of various components. Not all of them are magnetic. Some are plain stones. One can distinguish them that only some parts of the magnetic

stone attract iron filings. In one stone there are often many different magnets weaker and stronger, though apparently it seems to be one magnet [6]. Still other properties of magnets are directly self evident. Magnets move other, weaker magnets and attract them from a distance. A spherical magnet gathers around itself iron filings in the form of a sphere in two points, perpendicularly opposite, called poles; the filings gather into rods non-perpendicular to its spherical surface. The magnet gives iron the property of magnetic attraction. Besides, the magnet possesses a field of its power around itself. Magni called it „orbis”, „coelum magnetis”. Noting this phenomenon he explicitly quoted W. Gilbert's observations [7].

2. Existence and nature of the magnetic spirit

Basing on the above-described phenomena Magni comes to the following conclusions: the substantial cause of magnetic attraction of bodies is the magnetic spirit — „spiritus magnetis”, and not the bodies themselves; it results from the fact the magnetic attraction and the cause of movement can have only a spiritual nature [8]. The magnetic spirit causes the local movement which comes from the center of the magnetic body and that is why filings of the magnetic stone or of iron gather as a sphere near the spherical magnet. It is an unreasonable, inanimate spirit most resembling spirits of celestial globes since it, too, forms spherical bodies. It belongs to the group of spirits called „spiritus corporifici” — „body-creating spirits”. Filings are the material of which the magnetic spirit forms the spherical body [9].

However, no spherical magnetic bodies are found in the deposits of iron ore. It is due to the fact the magnetic spirit is derivative in relation to the spirit of the terrestrial globe, it is its much weaker „offspring”. It is well known — as Magni remarks — that in our „system of elements” consisting of earth, water and air only the spirit of the terrestrial globe forms spherical bodies. Smaller parts of the „elements” have the shape of spheres, drops of water are round, particles of air in water are also spherical the same refers to the grains of sand. The sphericity of bodies is not the result of the form of „combined bodies” consisting of those three elements but the result of movement caused directly by the spirit of the Earth or indirectly by a spirit created by the former. The magnetic spirit acts as dependent on the spirit of the Earth. So influenced it attracts filings and forms them into spheres on its poles [10].

The magnetic spirit dependent on the spirit of the terrestrial globe produces a magnetic body and controls it. The movements of the magnet poles are not as opposite to each other as not to have one and the same cause and belong to one, undivided body. The parts of a magnetic body are more firmly united than the magnetic stone where the magnet bodies are mixed with parts of another body [11].

There is no objection to assuming that the spirit or the Earth creates the magnetic spirit for its globe's good.

It is able to create, in parts of „elements”, spirits resembling itself, of lower or higher perfection according to the nature of the „element”. In the same way the Sun creates various lights in parts of „elements”. The magnetic spirit is one of such spirits derived from the spirit of the terrestrial globe. Those spirits are more perfect in the earth than in particles of water or air. The parts of earth are more solid deeper in the globe. But all have some magnetic power, maybe almost imperceptible, the same as numerous bodies which shine at night though the human eye does not notice it [13].

3. Subordinate role of the magnetic spirit

The role of the magnetic spirit in nature is much more modest than that of the Earth's spirit. The magnetic spirit is not a spirit that would control the globe because it creates its own „globe” in artificially created conditions. It only controls small „united” bodies. Its perfection is very low as compared to that of the Earth's spirit and its activity is analogous to the activity of the spirit of the terrestrial globe which also moves parts of its body from its center, positions its body polewise and unites its parts into a whole. Also this analogy in activity proves that the magnetic spirit is created by the Earth's spirit [14]. Though in natural conditions the magnetic spirit does not form a miniature globe resembling the terrestrial globe created by the Earth's spirit it should be assumed that it was formed in a normal way and so it is not a „monstrosity” as some are inclined to suppose [15].

The magnetic spirit is regulated by the Earth's spirit in the same way as the movement of a stone falling from a running horse is regulated by the direction in which the horse runs. The falling stone moves for some time in the same direction [16]. Thus it can be understood that the polewise arrangement of filings on the magnet confirms the provenience of the magnetic spirit from the Earth's spirit. The direct cause of the polewise arrangement of the filings on the magnet is the magnetic spirit which divides its power equally between both poles. The farther cause of this arrangement is the Earth's spirit. There is again an analogy between the magnetic spirit and the Earth's spirit. The latter keeps its position in the system of heavenly bodies owing to the axis of its globe tipped with poles. Owing to it this spirit can immobilize its globe and give the right direction to local movements occurring on the globe, otherwise the terrestrial globe would be abused by the spirits of other globes and condemned to chaotic movements caused by them [17].

The magnetic spirit is determined in still another way. The fact that it constantly directs the magnetic body towards a position conformable to the poles of the „daily movement” is due to its determination by a cause different from the Earth's spirit. The movement owing to which iron filings gather on the poles of the magnet is a local movement the natural cause of which is the magnetic spirit. However, the local movement of the magnet giving it a position conformable to the poles of the „daily movement” is different from the former [18]. The cause of this movement is the spirit controlling the Sun since in no case it can be attributed the Earth's spirit [19]. It is well known — says Magni — that the axis of the „daily movement” crosses the axis of the „yearly movement”, that is of the ecliptic, at an angle of 23.5 degrees. The spirit of the Earth directs its poles towards the poles of the „daily movement” to get proper light from the Sun. The spirit controlling the Sun is probably the cause of such a position of the Earth's poles [20].

According to Magni the magnetic spirit creates a zone of its activity beyond the magnet and the terrestrial globe, it acts there through its axis fields. That zone develops starting from the body first and directly moved by the magnetic spirit. It reaches beyond the body of the magnet and is not a body but a spiritual zone since it possesses a „direct magnitude”. According to Magni that fact explains the phenomenon of magnetic attraction at a distance [21].

The magnetic spirit gives iron much less of its magnetic power than it possesses itself which can be proved experimentally. The magnetic power of iron is weaker, it attracts only smaller bodies and spends itself [22].

Moreover, the magnetic spirit has no transitive movement independently of the magnetic body; it does not exert movement except through this body. The spirit does not exist outside the body though the zone of its activity observed beyond the controlled body does not come from another magnetic body [23]. The zone of the magnetic spirit

moves locally, parallelly, to the local movement of the magnetic body. That is why it cannot belong to a body other than the magnet.

4. Critical remarks on Magni's interpretation

The problem of magnet belongs to Magni's detailed cosmology in which also some others of his scientific views are outlined. He appreciated scientific discovers, observation and experiments. In spite of this we cannot find in his work any attempts of a mechanistic and mathematical interpretation of natural phenomena which is so evident in the work of Galileus, Marine Mersenne and others of their contemporaries. His opinions as those of Francis Bacon and some others did not develop problems of natural science but they abode by a qualitative interpretation of nature through spiritual powers, thus confusing experimental science and philosophy [24]. Nevertheless, from the historical point of view, we should appreciate in Magni's opinions his reference to the type of philosophy which solves problems through empiricism and experimentation [25]. Here — as it has been mentioned at the beginning — Magni's merits are well-known: they concern the solution of the problem of the possible existence of vacuum in nature — he proved it through experimentation. Instead, the theoretical interpretation of his experiments has no scientific value, because he underestimated the natural interpretation which he undoubtedly found in the work of Galileus and Blaise Pascal. His theory of atoms, light, heat and magnet, partly belonging to physics, as well as his views on astronomy are also of no value.

Magni's detailed cosmology is principally a philosophic theory and as such it is a closer application of general metaphysics and cosmology, where the chief place belongs to the Platonic theory of spirits controlling bodies and atoms building them. This is why Magni's views constitute a link in the controversy on the essence of the substantial form as the ultimate internal reason of bodies and on the question in what its relation to the body consists. This is an old controversy but it does not take place in physics only in the philosophy which considers the existence of souls and bodies to be equally real. Magni disregarded the Aristotelean views on the relation of the human soul and of the substantial forms of bodies to the matter shaped by them, declared for the Platonic-Augustinian view on the relation between the human soul and body [26] and extended it on all kinds of substantial kinds of bodies, assuming that also the substantial forms of inanimate bodies, plants and animals are spirits. His detailed cosmology is an illustration of his highly spiritualistic vision of the world.

By opposing not only spirit to matter but also souls of living beings, i.e. of humans, animals and plants, to spirits of inanimate celestial bodies and to the magnetic spirit Magni softened his spiritualism. We may conclude that, according to him, the latter are concentrations and centers of various „materializing” energies which, by their own power, create atoms and form bodies of them through liberation, i.e. gravitation of atoms towards the centers of celestial spheres which gravitation is given by spirits-energies controlling them.

From Polish to English translated Maria Jablonowska

REFERENCES

[1] Subotowicz M., The earliest printed description of an experiment showing the existence of vacuum, performed by Valerianus Magni in Warsaw in 1647 (in Polish), *Kwartalnik Historii Nauki i Techniki* R.4: 1959 n. 1, 35-104, tabl. 26; summaries in Russian and English, the latter re-edited in: *Collection de Travaux de l'Academie Internationale d'Histoire des Sciences*, publiée avec le concours de l'UNESCO, no.12. Actes du IX Congrès International d'Histoire des Sciences, Barcelona-Madrid, 1-7 Septembre 1959, vol. I. Barcelona 1961 Associaion para la Historia de la Ciencia Espanola, pp. 713 -715. See, too, id., The Portrait and Origin of Valerianus Magni 1586-1661, (in Polish), *Kwartalnik Historii Nauki i Techniki* R.33: 1988 n.2, 483-493, tabl.1.

[2] See: J. Cygan, Valerianus Magni, 1586-1661. „Vita prima”, operum recensio et bibliographia, Roma 1989, Institutum Historicum Capuccinum, p. 280-81, 290, 319-20.

[3] Valeriani Magni Fratris Capuccini Philosophiae... pars prima, in qua tractatus de paeripatu, de logica, de per se notis, de syllogismo demonstrativo, Varsavia 1648 P. Elert (Valerianus Theophilo, cap. 2), p. 12: „Ego suspicio in astrologia Ioannem (Nicolaum!) Copernicum; in eadem faculate et nonnullis questionibus physicis Galilaecum de Galileis; in revelanda occulta natura magnetis, quae rite cognita aperit viam perscrutandi structuram machinae mundanae, Gulielmum Rhobertum (Gilbertum!) Anglum”.

[4] The name of William Gilbert, in correct form „Gilbertus Anglus” reappears in Magni's treatise on magnet which we quote here after a hand-written copy of his philosophy deposited by William Leibniz in a library of Hannover, call number: Ms IV 322, ff. 150v-156 rv: *Tractatus Sextus. Magnes where W. Gilbert is named in f. 151 v.* The title of Gilbert's work by which Magni profited is: *Gulielmus Gilbertus Cocestrensis, Tractatus, sive Physiologia Nova de Magnete, magneticisque corporibus et magno magnete tellure, sex libris comprehensus, Sedinii 1633.* It is not excluded that Magni used the edition published by Marian Marsenne in his: *Cogitata physico-mathematica (1644).*

[5] That is the north-south direction. Ms. IV 322 Tr. VI, cap 1, f. 151 r.

[6] *Ibidem*

[7] *Ibid.*, cap. 2, f. 151, rv

[8] *Ibid.*, cap. 3, f. 151 v: „Iteque magnes loco movet magnetem loco a se distantem...id, quod loco movet magnetem, non est corpus, sed spiritus, quem dicimus magneticum”.

[9] *Ibid.*, cap. 5, f. 152 r.

[10] *Ibid.*, f. 152 rv.

[11] *Ibid.*, cap. 6, f. 152 v.

[12] *Ibid.*, f. 153 v: „Persequimus tamen exponere naturam spiritus magnetici eatenus producti a spiritu astri terreni. — Arbitror hunc spiritum indeficienter moventem totum systema elementare producere spiritus sibi analoges in singulis partibus elementorum sed plus minusve efficaces pro diversa ratione partium, non secus ac v.g. sol producit lumina sibi analogia in partes elementorum”.

[13] *Ibid.*

[14] *Ibid.*, f. 153 rv.

[15] *Ibid.*, f. 153 v. In Magni's opinion the souls animating plants and animals having no proper matter and acting out of necessity of their nature create monstrosities.

[16] *Ibid.*, f. 154 r.

[17] *Ibid.*, cap. 7 (87), f. 154 r; cap. 9, f. 154 v.

[18] *Ibid.*, cap. 8, f. 154 r.v.

[19] Ibid., cap. 9, f. 155 r: „Quoniam vero spiritus magnetis producitur a spiritu astri terreni inde non habet directionem suorum polorum ad eosdem polos motus diurni. Habet porro a spiritu corporifico corporis solaris. . .”.

[20] Ibid., f. 154 v.

[21] Ibid., cap. 10, f. 155 r: „... Spiritus magnetis extendit axem suum suis polis ad proprium orbem. . . spiritus magnetis movet primo sive immediate corpus sibi subiectum sine organo corporeo et hinc explicat coelum suum longe lateque extra corpus magnetis, non tamen longitudine. . . corporea, sed spirituali, eminenti et directa”.

[22] Ibid., cap. 11, f. 155 rv

[23] Ibid., f. 155 v

[24] In these critical remarks we refer to the considerations of a distinguished expert in the origin of natural sciences, Robert Lenoble in his book: *Les origines de la pensée scientifique moderne*, in: *Histoire de la Science*, Paris 1957, Librairie Gallimard. We used the Italian translation: *Le origini del pensiero scientifico moderno*. Roma-Bari 1976 Editori Laterza, particularly the chapters: V, *L'esplosione*” meccanicista, and VI: *L'uomo e la scienza nel Seicento*. pages 129–188.

[25] The problems Magni touches are: falling of bodies, inertia, libration, reciprocal attraction of globes. By the above remark we mean that Magni should not be overestimated as physicist as it seems to happen in some general publications. See: Henryk Barycz: *The history of science in Poland in the time of Renaissance*, (in Polish), Warsaw 1957. H. Barycz considers him to be a great physicist. Also his information that Magni's experiment concerning vacuum started „a long-lasting argument between him and Torricelli” is wrong. See *ibid.* p. 198.

[26] It results from his definition of man given in his work *De per se notis*, Varsavia 1648 P. Elert, p. 30–31: „... Hominem esse quoque principium intellectivum, quod tamen adhibeat corpus animale, obeundis functionibus intellectus. . . homo sit intellectus animalis. non animal intellectuale, . . .”. Magni tried to defend against dualism such an idea of man and of a being composed of soul and body by emphasizing their unity. Magni's view on the relation of the human soul and body reminds of Rene Descartes dualism. The Cartesians of the seventeenth century developed the dualism of soul and body into the extreme form of occasionalism (Nicolaus Malebranche).