"Long Before Faraday"

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The only known opus of Titus Lucretius Carus, *The Nature of Things*, written at Rome in the first century before Christ, is a vast hexameter poem that combines science and spirituality under the spell of Epicurus, the Greek philosopher of the 4th century B.C.E. It was a discovery of the Renaissance, having virtually lost and unknown throughout the Middle Ages (after the Carolingian period), but then found again in 1417 in a South German monastery by Poggio Bracciolini (renowned indefatigable book-hunter and brilliant scribe in the papal curia who rose in the course of a 50-year career to become *scriptor apostolicus*, secretary to the pope). [1]

The poem touches on many matters that continue to inspire or puzzle modern science today, among them:

-Everything is made of invisible atoms[2];
-The elementary particles of matter are eternal;
-All particles are in motion in an infinite void;
-Everything comes into being as a result of a "swerve";[3]
-Nature ceaselessly experiments;
-The universe was not created for or about humans;
-Divinity did not take part in the making of the universe;
-The highest human goal is the enhancement of happiness[4]
- Understanding the nature of things generates "deep wonder";[5]
-The earth revolves around the sun (fire);
-The vital spirit is present in the whole human body and dies with it;

To add to the "deep wonder" (Greenblatt 198) let us look at a passage in book 6. Lucretius introduces his topic:

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[1] Stephen Greenblatt, *The Swerve: How the World Became Modern* (New York, 2011).

[2] *Corpora prima*, translated "atoms," but he does not use the Greek word, I.60.

[3] Greenblatt cit.

[4] The avoidance of pain, worry and fear. Jefferson's "pursuit of happiness" derives from this thought. II.18-19: *corpore seiunctus dolor…iucundo sensu cura semota metuque.*

[5] Greenblatt cit. …II. 1046-7: *velit mens/ atque animi iactus liber quo pervolet ipse.*

"At this point I will set out to explain what law of nature causes iron to be attracted by that stone which the Greeks call from its place of origin 'magnet' because it occurs in the territory of the Magnesians."[6]

Then he tells us what he has himself found specially remarkable:

"It also happens that iron moves from this stone; its tendency is to flee and to pursue by turns. I have even seen the Samothracian rings of gilded iron jump up and iron filings grow restive inside copper cups when this magnet stone was put under them. So eager was the iron to run from the stone…." [7]

"The reason why the interposition of copper causes such a turmoil is doubtless this. After the effluence of the copper has first taken possession of the open passage–ways in the iron and occupied them, along comes the effluence of the magnet and finds everything full in the iron and so has no way of passing through as before. It is therefore compelled to pelt and batter the texture of iron with its stream. In this way it repels the iron from itself and through the copper it drives away what otherwise it normally attracts….Iron…needs only the addition of some particles of copper and then it yields to the current from the Magnesian stones."

Lucretius seems closely and intelligently to have anticipated Michael Faraday, by some 1800 years, observing the properties of what we now call " electromagnetic force" producing the motion of the "iron filings inside the copper cup," both attraction and repulsion, "exulting" Lucretius calls it, leaping ecstatically from one position to another. For what he has recorded is not just the attraction of iron and magnet, but also the repelling effect as well which is due to the electric current induced by a moving magnet with the crucial addition to iron of copper, Faraday's experiment of 1831.

Faraday's observation of electromagnetic force was devoted to the proposition that "useful mechanical work" could hereby be unleashed, and indeed, the result is ongoing in today's ubiquitous electric rotor machinery

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[6] . Latham trans..243-4. VI. 962, *Quod super est, agere incipiam quo foedere fiat naturae, lapis hic ut ferrum ducere possit,/ quem Magneta vocant patrio de nomine Grai, Magnetum quia sit patriis in finibus ortus.*

[7]. Latham trans 248. IV.1043-1046 *Fit quoque ut a lapide hoc ferri natura recedat/ inter dum, fugere atque sequi consueta vicissim. exultare etiam Samothracia ferrea vidi/ et ramenta simul ferri furere intus ahenis /in scaphiis, lapis hic Magnes cum subditus esset;/ usque adeo fugere a saxo gestire videtur*

(generators and motors) and upcoming linear-motor magnetically levitated vehicles (MAGLEVs).

Lucretius's record of the ancient "Samothracian" demonstration of the same phenomenon was purely theoretical in motive, with no interest in technological application, and typically Roman in this regard.[8] The strange and weird effects of magnetism give us a rare, odd, fleeting *aperçu* into the true nature of all physical reality, which usually we don't notice, which usually doesn't strike us. Yes, if we hold the bottom of a bronze bowl we can feel the temperature of a very hot or very cold liquid poured into it. We can smell smoke from afar, smell odors seeping through all sorts of things, sense our own sweat exuding. But we don't grasp what these experiences indicate. When we see one sturdy metal move another without even touching it, then the fact is finally inescapable.[9] There is nothing very solid about solid matter and nothing inert about it at all: it is all made up of tiny particles constantly in motion, vastly surrounded by empty space, careering, careening onto each other through the void, moving each other ("effluence," "emanation") causing all things to happen. The life of the world is not in the mind of gods or humans, but in the eternal tension of atoms influencing each other across space.

As with all ancient scientific discoveries, the modern world rediscovered them in different contexts, but still, Lucretius's anticipation is worth noting, as it inspired after centuries those people that made our modern world thrive by their talent and dedication, that is, by the goodness of their "deep wonder."

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[8] In the Augustan, then Julio-Claudian period, the Roman Empire certainly still seemed to dispose of limitless slave power.

[9] He can't emphasize it enough: VI.936-958, Nunc omnis repetam quam raro corpore sint res/commemorare; quod in primo quoque carmine claret/... quandoquidem nihil est nisi raro corpore nexum: isolated particles spread out with nothing between them (but space) in constant agitation.