THE RETURN OF THE ETHER PART 2

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THE SPACE THEORY OF MATTER AND VORTEX ATOMS

The Space Theory of Matter

In 1875 W. K. Clifford, the translator and supporter of Riemann who believed space was not homogenous but shaped by the presence of matter, and that the current geometries were all idealisations, wrote an illuminating paper *On the Space-Theory of Matter* which, as it is short, I will quote in full:

'Riemann has shown that as there are different kinds of lines and surfaces, so there are different kinds of space of three dimensions; and that we can only find out by experience to which of these kinds the space in which we live belongs. In particular, the axioms of plane geometry are true within the limits of experiment on the surface of a sheet of paper, and yet we know that the sheet is really covered with a number of small ridges and furrows, upon which (the total curvature not being zero) these axioms are not true. Similarly, he says, although the axioms of solid geometry are true within the limits of experiment for finite portions of our space, yet we have no reason to conclude that they are true for very small portions of space.

I wish here to indicate a manner in which these speculations may be applied to the investigation of physical phenomena. I hold in fact:
(1) That small portions of space are in fact of a nature analogous to little hills on a surface which is on the average flat; namely, that the ordinary laws of geometry are not valid in them.
(2) That this property of being curved or distorted is continually being passed on from one portion of space to another after the manner of a wave.
(3) That this variation of the curvature of space is what really happens in that phenomenon which we call the motion of matter, whether ponderable or etherial.
(4) That in the physical world nothing else takes place but this variation, subject (possibly) to the law of continuity.

I am endeavouring in a general way to explain the laws of double refraction on this hypothesis, but have not yet arrived at any results sufficiently decisive to be communicated.' [Proceedings of the Cambridge Philosophical Society 1876 p157]

From this, the picture emerges of a phenomenal world in flux, and material objects simply more dense than the surroundings and therefore giving rise to 'inertia' or 'persistence': these concepts can be analysed as relative densities and gradients. The ether is not required as space itself provides the dynamic

medium. This approach also gels with Einstein's GTR.

Shape, stability and the Vortex Atom

One of the difficulties facing the space theory of matter and wave mechanics generally is that waves dissipate and loose their structure so cannot provide a stable structure for the atom. After reading a paper by Helmholtz, William Thomson (aka Lord Kelvin) was inspired to develop the idea of a vortex atom and wrote:

'Diagrams and wire models were shown to the Society to illustrate knotted or knitted vortex atoms, the endless variety of which is infinitely more than sufficient to explain the varieties and allotropies [e.g. carbon molecules can be structured as diamonds or graphite etc] **of known simple bodies and their mutual affinities. It is to be remarked that two ring atoms linked together or one knotted in any manner with its ends meeting, constitute a system which, however it may be altered in shape, can never deviate from its own peculiarity of multiple continuity, it being impossible for the matter in any line of vortex motion to go through the line of any other matter in such motion or any other part of its own line. In fact, a closed line of vortex core is literally indivisible by any action resulting from vortex motion. . . . a very important property of the vortex atom, with reference to the now celebrated spectrum-analysis practically established by the discoveries and labours of Kirchhoff and Bunsen. . . . required that the ultimate constitution of simple bodies should have one or more fundamental periods of vibration, as has a stringed instrument of one or more strings, or an elastic solid consisting of one or more tuning-forks rigidly connected. To assume such a property in the Lucretius atom, is at once to give it that very flexibility and elasticity for the explanation of which, as exhibited in aggregate bodies, the atomic constitution was originally assumed.'**
[*On Vortex Atoms*, Lord Kelvin (Sir William Thomson) Proceedings of the Royal Society of Edinburgh, Vol. VI, 1867, pp. 94-105. Reprinted in Phil. Mag. Vol. XXXIV, 1867, pp. 15-24]

See Figures 1(a) and (b) below for variations of shapes, produced by Lord Kelvin in the theory of atomic vortices.

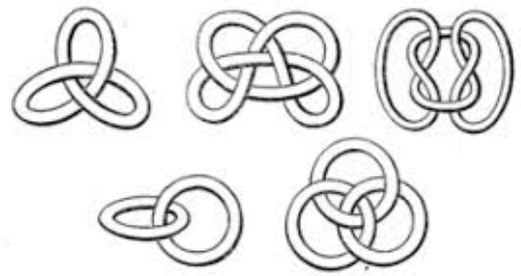

Figure 1(a)

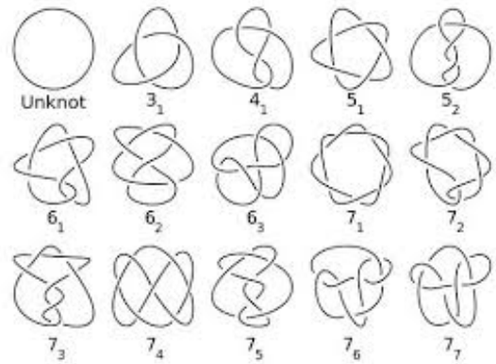

Figure 1(b)

Following this, Peter Guthrie Tait set up an experiment with smoke rings with astonishing results:

'On a day in mid-January, 1867, Peter Guthrie Tait set up some homely apparatus in his lecture room at Edinburgh and proceeded to create a 'magnificent display' of smoke rings. Expelled from two boxes situated at varying angles from one another, the smoke rings behaved in a most curious manner. When two rings were made to travel in the same direction with their centres in the same line and their planes perpendicular to this line, the leading ring expanded and moved more slowly; the pursuing ring contracted and moved faster; and each in turn passed through the other. When, however, two rings were made to approach each other from opposite directions, both of them expanded and moved more and more slowly, never quite touching. Propelled toward each other at oblique angles, the rings glanced off each other without coming into actual contact and thereafter went into a state of violent vibration. No less remarkable was the fact that individual smoke

rings resisted all efforts to cut them with a knife. No matter how vigorous the slicing motions, the rings simply moved away from, or wriggled around, the sharp instrument. Conceived and executed as an illustration of the vortex theory, this demonstration was frequently to be repeated.'
[Robert Silliman William, *Thomson: Smoke Rings and Nineteenth-Century Atomism* ISIS 1963 Vol 54 No 178 p 461]

Lord Kelvin was skeptical about the existing atomic theory:

'The older theory, which conceived of atoms as hard, elastic bodies moving in empty space, maintained its currency primarily because it proved useful in understanding the behaviour of gases. In Thomson's mind, however, the theory had little to recommend it. It was conceptually barren and in reality explained nothing. His objection, as stated in the initial paper on vortex atoms, was that the proponents of the Lucretian atom *arbitrarily endowed it with exactly those characteristics it was supposed to account for on the molar level:* "Lucretius's atom does not explain any of the properties of matter without attributing them to the atom itself. Thus the 'clash of atoms,' as it has been well called, has been invoked by his modern followers to account for the elasticity of gases. Every other property of matter has similarly required an assumption of specific forces pertaining to the atom." The hard, elastic bodies singularly failed to explain the findings of spectrum analysis, unless vibration was simply assigned to the atom as one of its properties.' [*ibid*, my italics]

Could anything be more clear.

J. J. Thomson was inspired to write *A Treatise on the Motion of Vortex Rings* published by Macmillan in 1883. He explained:

'I was greatly interested in vortex motion since Sir WilliamThomson had suggested that matter might be made of vortex rings in a perfect fluid, a theory more fundamental and definite than any that had been advanced before. There was a spartan simplicity about it . . .' [quoted in *J. J. Thomson and the Discovery of the Electron* by E. A. Davis and I. J. Falconer, Taylor and Francis 1997, p16]

One of his conclusions was that:

' . . . the vortex theory of matter is of a much more fundamental character than the ordinary solid particle theory, since the mutual action of two vortex rings can be found by kinematical principles, whilst the "clash of atoms" in the ordinary theory introduces us to forces which themselves demand a theory to explain them.' [*ibid* p32]

The theory was abandoned as more information about the internal structure of the atom came to light. However Schrödinger breathed new life into it and emphasised shape or structure as the fundamental characteristic of mass:

'Let us now return to our ultimate particles and to small organisations of particles as atoms or small molecules. The old idea about them was that their individuality was based on the identity of matter in them. This seems to be a gratuitous and almost mystical addition that is in sharp contrast to what we have found to constitute the individuality of macroscopic bodies, which is quite independent of such a crude materialistic hypothesis and does not need its support. The new idea is that what is permanent in these ultimate particles or small aggregates is their shape and organisation. The habit of everyday language deceives us and seems to require , whenever we hear the word 'shape' or 'form' pronounced, that is must be the shape or form of something, that a material substratum is required to take on a shape. Scientifically this habit goes back to Aristotle, his *causa materialis* and *causa formalis*. But when you come to the ultimate particles constituting matter , there seems to be no point in thinking of them again as consisting of some material. They are as it were, pure shape, nothing but shape; what turns up again and again in successive observations is this shape, not an individual speck of material.' [*Science and Humanism*, 1951 CUP and reprinted CUP 1996]

This in turn echoes Faraday's speculation:

'What real reason, then, is there for supposing that there is any such nucleus in a particle of matter.'
[*A Speculation touching electric conduction and the nature of matter*, 1844]

The answer is mathematical convenience, in the same way as Newton treated a planet as a point. The physics gives a different: picture: there is no duality between an electron and its electromagnetic field just changes in

concentration or density, caused by physical gradients in for example temperature and pressure, vibrations and other types of motion.

Analogies with Fluid Mechanics

An illuminating analogy for gradients in the electro-magnetic field is with fluid mechanics where Bernoulli's theorem shows how fluid flows quickly in places where the pressure is low, and more slowly when the pressure is high. A common misconception is that aeroplanes experience lift and sail boats experience pushing when their sails are out, whereas the first is being sucked up into the sky and the latter sucked across the sea. What is clear is the effect of differential gradients in determining motion and this motion in turn determines the shape.

David Tong in his book on *Fluid Mechanics* [CUP 2025 pp 37-38] admits that there might be a grain of truth in Lord Kelvin's idea of a vortex atom:

'In quantum field theories, certain particles arise as so-called "solitons" in which the fields wrap themselves in some stable configuration that has some similarities to vortices in fluids. (There are, admittedly differences. The vortices in fluids are not really solitons, although similar vortices that arise in superfluids and superconductors are.)

From a certain perspective, the proton and neutron can be viewed as solitons of an underlying pion field, known as a *skyrmion*. (Admittedly, the more familiar story of the proton and neutron as made from three quarks is a more fundamental perspective.) Magnetic monopoles, if they exist, would be examples of solitons.'

To my mind, this sounds like someone who is conflicted and it highlights the two approaches to the physics: the first is visualisable and easily understood and the second is mired in jargon that defies comprehension mainly because of the inclusion of a 'pion field' which is made up of quarks and anti-quarks. It came as a surprise to me to find out that 'solitons' are a special type of long-wave that are non-dispersive and travel in the form of packets with constant velocity. They are also called shallow-water waves with a permanent shape. A soliton has the special property that its shape remains unchanged when it collides with another soliton. This phenomena was not discovered recently at CERN but by a Scottish naval architect, John Scott Russell in 1834. Similarly a 'skyrmion' is a topologically stable vortex-like configuration in a magnetic field proposed by Tony Skyrme in 1961, a British physicist who was influenced by Lord Kelvin. I consider it unfortunate that these ideas have been grafted onto particle physics (in the form of the pion field) rather than used to develop Lord Kelvin's intuitions on vortex atoms.

Nevertheless it is useful to see the connection between the early version of vortex atomic structure and the more complex topology of more recent geometric models such as the Hopf fibration: see Figures 2 (a) and (b) below.

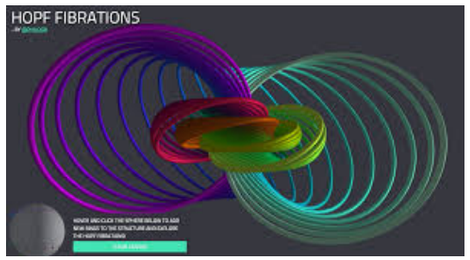

Figure 2(a)

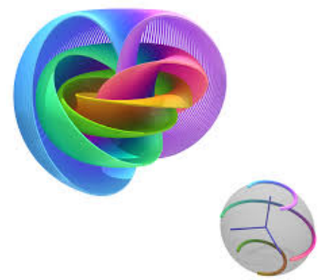

Figure 2(b)

The Hopf fibration was discovered by Heinz Hopf in 1931. He was attempting to describe continuous deformations, or lack of them, in certain spaces: 1-sphere is a unit circle in the plane; 2-sphere is the surface of a solid unit sphere in 3 dimensions and so on. Every point on the 2-sphere produces a fiber that is a circle, any two of which are linked. Points that share a latitude produce a torus and the tori produced at each latitude are nested inside one another. 'Fibration' means that one topological shape can be deformed or morphed into a new shape continuously via a mathematical mapping. This procedure can be projected onto higher dimensional shapes, using stereographic projection ie mapping points of a sphere onto a plane. This structure has been used to provide a basis for atomic structure:

'The important issue for us here is to what extent our proposed geometrical model based on algebraic surfaces is compatible with these nuclear phenomena, not forgetting the electron structure in a

neutral atom. There are some broad similarities. First there is the "geography" of surfaces we have discussed above, implying that the geometrical inequalities restrict the range of neutron numbers. Algebraic geometers also refer to "botany, " the careful construction and study of surfaces with particular topological invariants. The patterns are very complicated. Some surfaces are simple to construct, others less so, and their internal structure is very variable. This is analogous to the complications of the nuclear landscape, and the similar complications (better understood) of the electron orbitals and atomic shell structure.'

and

'We have proposed a new geometrical model of matter. It goes beyond our earlier proposal in that it can accommodate far more than just a limited set of basic particles. In principle, the model can account for all types of neutral atom. Each atom is modelled by a compact, complex algebraic surface, which as a real manifold is 4-dimensional. The physical quantum numbers of proton number P (equal to electron number for a neutral atom) and neutron number N are expressed in terms of the Chern numbers c12 and c2 of the surface, but they can also be expressed in terms of combinations of the Hodge numbers, or of the Betti numbers b1, b2+ and b2−.'

[M. F. Atiyah and N. S. Manton *Complex Geometry of Nuclei and Atoms*, International Journal of Modern Physics A Vol 33 No 24 (2018)]

This is an indication that a unified theory based on non-Euclidian geometry as envisaged by Riemann, Einstein and others is a real possibility. It is important to remember that Einstein's metaphysical point of view is predominately mathematical in nature. In his 1930 essay *Space, Ether, and Field in Physics* [Beyond Geometry, Classic papers from Rieman to Einstein edited by Peter Pesic, Dover Publications, 2007] he explains the transition from Newton's absolute space to the luminiferous ether to fields and to his space-time. It is clear from his account that the geometric approach does help to unify disparate phenomena, but Einstein did not go far enough in ridding his metaphysical outlook of unnecessary dualities and even after his theories of special and general relativity, the ontology included space and matter; fields and particles which lead to absurdities.

It is also worth noting two further points. From a very simple shape together with a simple equation a tremendous amount of complexity can be generated. See *The Recursive Universe* by William Poundstone. Also fractal geometry where the mathematical mechanism of a feedback loop can produce shapes exhibiting periodicity like waves do, and are scaleable from the infinitely small to the infinitely large, is perhaps a better candidate for a unified field than the Hopf fibration. See the short note on non-Euclidian geometries and Infinity in the Additional Material for this essay.