THE PARTICLE MENACE PART 3

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FAREWELL TO PRIMITIVE CONCEPTS

Farewell to Primitive Concepts

Introduction

It is clear that that the occult and atavistic concepts such as force, energy and charge are useful up to a point, especially if the objective is of a purely practical or instrumentalist approach. In delving into ontology, these concepts are inadequate and result in confusion. They have to be replaced by analysing them in terms of motion, direction, frequency and shape (or form).

Energy

Faraday's great insight over a century ago, that all phenomena (the electrons and the fields) were composed of the same fundamental substance but in different concentrations) has been largely ignored in the pursuit of technological advantage by most physicists. Schrödinger was one of the exceptions:

'The concept of 'energy' is something that we have derived from macroscopic experience and really only from macroscopic experience. I do not believe that it can be taken over into micro-mechanics just like that, so that one may speak of the energy of a single particle oscillation. The energetic property of the individual particle oscillation is its frequency.' [Letter to Max Planck May 31 1926 quoted in Max Jammer's book *The Philosophy of Quantum Mechanics* p 29]

This is clear from E=*hf* where the frequency is divvied up to manufacture individual particles which in turn produce a balanced accounting record of the photo-electric effect. By dispensing with the concept of energy, it follows that the principle of 'the conservation of energy' which forms the basis of the stationary states and quantum jumps view of the structure of the atom is irrelevant.

'I am sure that if an advocate of the orthodox view cares to argue the case with me, the first thing he is going to tell me is, would I please have a look at a line spectrum and see that the levels are not blurred but very sharply distinguished and privileged. But this argument is based on the idea that an observed spectral frequency is emitted by single atoms jumping from a certain higher level to a certain lower level, each atom producing in this process a photon with energy equal to the difference of the two levels. This, of course, presupposes the detailed validity of the conservation law, which is

just the point under discussion that I do not take for granted.' [Schrödinger *Might Perhaps Energy be Merely a Statistical Concept*, Nuovo Cimento (1958) pp162-170][1]

Schrödinger continues in this paper to draw comparisons with thermodynamics and entropy where Boltzman had reinterpreted entropy as the statistically more probable state of a system:

'Thermodynamic equilibrium is only an abstraction, a limiting case that in actual fact is never met with. No system that we observe has a sharply determined energy value, nay we must not even admit this in the mental images we invent in order to describe what is going on. For nothing that takes part in what is going on has a well defined energy. Is that not rather in favour of the view I am advocating, that energy, just like entropy, is a statistical concept? Any display of physical events, while to the classical view it was taking place within or between systems of well defined energies, is quantum-mechanically represented by state functions that do not depend on time just by one imaginary exponential factor with one single frequency, but by a superposition of several, as a rule a great many such terms, covering a discrete or continuous range of frequencies, though it may be restricted to a narrow domain of the spectrum. Only in this way can one obtain a representation of something happening, an evolution in time. (The situation is mathematically analogous to the well known, not to say ill-famed (because wrongly used), wave parcel.) These considerations fortify my conviction that for small systems – with few degrees of freedom – one ought not to consider the product of Planck's constant and the frequency as meaning a definite amount of energy, while for macroscopic systems this relation is, of course, indispensable for the theory of thermodynamics and ought itself to be given a statistical foundation.'

And in his Collected Papers on Wave Mechanics quoted by Max Jammer [*ibid*, p33)] arrives at Faraday's intuition:

' In a footnote . . . Schrödinger admitted, in particular, the conceptual inconsistency of using, for instance, in the wave mechanical treatment of the hydrogen atom, the formula for electrostatic potential of classical particle physics, adding that the possibility must be reckoned with that the carrying-over of the formula for the classical energy function loses its legitimacy "when both 'point charges' are actually extended states of vibrations which penetrate each other." Shrödinger's concern was fully vindicated by the later development of QED.'

The last sentence by Max Jammer must refer to the the infinite energy around a charged point particle from the equations used by proponents of QED and the dubious 'renormalisation' procedure used to mathematically rid themselves of this result. See the next essay on Fields and the accompanying additional material.

It is clear form Schrödinger's analysis that failure to recognise that the particle view of the phenomena is derivative, and logically secondary to the wave description, gives rise to all the endless equivocations of Bohr's principle of complimentarity (a false conclusion drawn from amongst other things Schrödinger's proof that wave mechanics could be translated into matrix mechanics) and Heisenberg's uncertainty relations. Mara Beller points out how the Copenhagen cabal did everything they could to discredit Schrödinger:

'After Einstein, Schrödinger was the most prominent and the most adamant opponent of the Copenhagen Interpretation of quantum physics. As in Einstein's case, the Copenhagen orthodoxy trivialised Schrödinger's objections and understated his prominent insights. Goittingen-Copenhagen physicists presented Schrödinger as a reactionary, hopelessly trapped in the deterministic, naively realistic modes of thought of classical physics. . . ' [*Against the Stream - Schrödinger's Interpretation of Quantum Mechanics, Dublin Seminars and other unpublished essays* Ox Bow Press 1995]

This attitude has resulted in a great loss to physics and philosophy as I believe Schrödinger's vision has tremendous explanatory power compared to the abstruse reasoning of the particle physicists.

Mass

If energy is identified with frequency then from Einstein's equation, so too is mass. Looking at the shapes in Figure 1 below one can see how the interaction of different frequencies along different paths or directions can produce areas of varying densities. The unoccupied space we assume in everyday matters, is really teeming with elements and molecules: oxygen, hydrogen, nitrogen and carbon dioxide etc together with electromagnetic

radiation as the spectrum of colours nevertheless we think of space as 'empty' and homogenous.

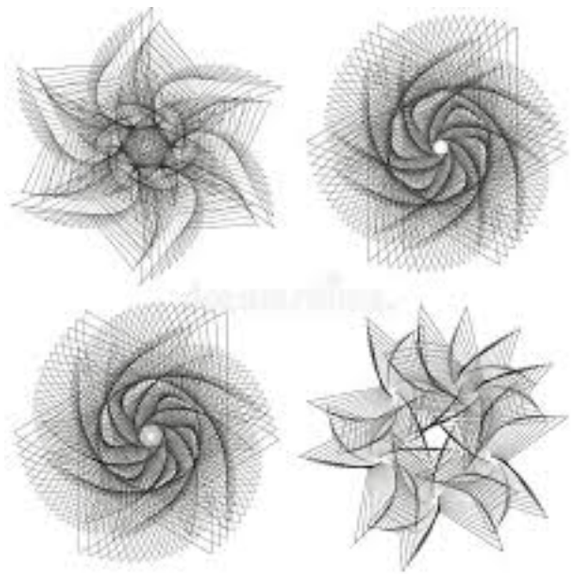

Figure 1 shapes using a superposition of spirograph images

The phenomenal world is a vibrating interaction of different frequencies and amplitudes moving in different directions, utilising different types of motion, with varying shapes and densities. All the attributes of waves apply.

Sir Arthur Eddington also took a stab at reformulating mass as density as Max Jammer has pointed out:

' . . . to assign a density directly to the wave function with a distribution over the nominally infinite wave front. Integrating this "density" over all three dimensional space would then yield the mass value of the particle represented by the wave or wave packet. Such a definition of "mass" in quantum mechanics, was, in fact, employed by Eddington in his reformulation of the exclusion principle by assigning a saturation value for the "density" of an elementary wave function.' [Max Jammer, *Concepts of Mass* p 193 and Eddington, *A New Derivation of the quadratic equation for the masses of the proton and electron*, Proceedings of the Royal Society 174, 16-41 (1940)]

Eddington states clearly in this paper that the equivalence between the saturated density of a system and defining this as a 'particle' is a 'circumlocution':

'Accordingly, in extending relativity theory to microscopic physics, our starting-point must be *the representation of density in wave mechanics rather than the representation of mass or energy*. By the general principles of wave analysis the whole density of the system is considered to be the sum of contributions from a set of elementary wave functions. By a survival of classical terminology we often describe the density associated with a particular wave function as due to a particle occupying the state which the wave function describes. This circumlocution is difficult to avoid, though it often involves using the term "particle" in a sense remote from ordinary conception. If we assign the density and other physical characteristics directly to the wave function, we have to reword the exclusion principle appropriately. The density contributed by an elementary wave function has a saturation value which cannot be exceeded; the actual contribution may be any fraction p ($0 \leq p \leq 1$) of the saturation value. A wave will be said to be " fully occupied" if the density has the saturation value; and p will be called the " degree of occupation" or " occupation factor".

Our point of entry into wave mechanics is therefore the density of a fully occupied wave function in contrast to elementary quantum theory which begins with the mass (or energy) of a particle.' [my italics]

Following Faraday it is clear that this analysis which unifies mass and space via wave mechanics, avoids the many pitfalls of pursuing a false dichotomy inherent in the particle view, of mass plus space, ether or a void.

Force and Charge

The last of the occult concepts could also be reformulated in these terms. The charge of the proton and electron have equal but opposite values while the proton has a mass 1836 times greater than the electron. So charge is not proportional to mass or as reformulated the density of the wave formation. Resort has to be made to nuclear forces to explain why the protons stay united in the nucleus rather than repelling each other. Pauli's exclusion principle is used to explain why the electron doesn't fall into the nucleus.

Retaining a particle view of the phenomena leads to the necessity of introducing 'forces' and what follows is the unpalatable and unavoidable 'action at a distance'. To get round this problem Heisenberg and Majorana introduced 'exchange forces':

'This was done in analogy to the quantum-mechanical theory of covalent bonds, such as exist between two hydrogen atoms in the hydrogen molecule: the chemical force is attractive if the wave function is symmetric under exchange of the co-ordinates of the electrons and is repulsive if the wave function is antisymmetric in this respect.' [Max Jammer, *Concepts of Force*, Dover Publications, 1957, p253]

Unfortunately, the 'exchange of forces' were envisaged as an exchange of 'force carrying particles' and so the particle view mushroomed. Logically, retaining a particle view is untenable because discrete entities have to be differentiated from their surroundings and the intervening space between any two particles cannot be bridged by the introduction of many more particles. It just moves the problem into smaller dimensions.

'No kind of arrangement will ever be found which can make a genuine substance out of a number of entities by aggregation.' [Leibniz, *Correspondence with Arnauld, Philosophical Writings*, J.M. Dent & Sons 1973 p70]

The idea of replacing charge and force with complimentary shapes of a configuration of waves which can be superimposed on each other to represent 'attraction' and asymmetric waves out of synchronisation representing 'repulsion' is a more robust and satisfying description. In analysing force in special relativity, Max Jammer states that

' . . . on grounds of rejection of an absolute simultaneity of two distant events, special relativity comes to the conclusion that action at a distance has to be excluded as a legitimate physical notion. Forces, in other words, can only be contact forces.' [*ibid*, p257]

This rules out a large part of a particle description because they have 'charges' and there is no 'contact' between two repelling particles or attractive particles. It is, like energy, imported from classical physics with a billiard ball analogy. Only quantum phenomena that can be built up through superposition, namely waves, can 'contact' acquire an ontological and logical meaning. One can view the concept of charge as shorthand as is much of the nomenclature in electrodynamics. A constructive exercise is to read the correspondence between Faraday and William Whewell on the appropriate terminology of the new physics of electricity:

'The usual notions attached to positive and negative and to the term current, I suspect are altogether wrong but I have not a clear view of what ought to be put in their place.' [Faraday, April 24 and 25 1834, Royal Institute, London]

Faraday also thought of aligning the two charges with a line of latitude of the Earth's magnetic field and naming them 'east-node' and 'west-node'. This would capture the directional motion of two waves, either coming together (as in attraction of proton and electron) in a superposition or moving apart (as in repulsion of two protons) in a form of reflection as each proton bounces off the boundary of the other. The protons in a nucleus could be considered to combine in a synchronistic way where they pulse in unison and something similar for electrons. See Figure 2 below as a possible configuration of the H atom based on wave mechanics.

In the GTR the force of gravity is replaced by the geometry of space-time:

'It was the theory of general relativity that led to a more profound revision of the concept of force, a process that is far from being completed even at present. In fact, it has been carried out successfully so far only with respect to gravitational forces. Its generalization for nongravitational forces, and primarily (and perhaps only) for electromagnetic forces, is intimately connected with the problem of the so-called "unified field theories." [Jammer, Max, *ibid*, p257]

The GTR replaced gravitational force but could have gone further in uniting mass and space. Max Jammer concludes his book on force by assuming that any future unified field theory must adopt an approach similar to the GTR in order to banish the concept of force for ever. Newton after all never intended it to mean anything other than a mathematical device:

'The words attraction, 'impulse' or any propensity to a centre, however I employ indifferently and interchangeably considering these forces not physically but merely mathematically. The reader

should hence be aware lest he think that by words of this sort I anywhere define a species of mode of action or a physical cause or reason.' [*Principia*, 1687]

It should also be remembered that the constant G in the inverse square law is designed to transform mass and distance into a force expressed as mass and acceleration is a number derived from experiment and has no theoretical foundation.

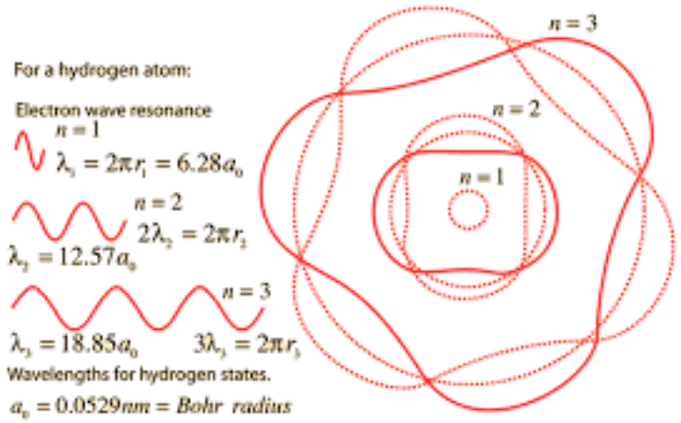

Figure 2

Electromagnetic force and the strong and weak nuclear force can be replaced once charge is thought of as a type of motion of a superposition of standing waves with certain densities and orientations. For example, following on from Schrödinger's speculation on energy at atomic level being interpreted as frequency, the energy deficit in the nucleus (ie that the total energy or mass of the nucleus is less than the combined individual energy or mass of the protons and neutrons) could be explained naturally as the cancelling out due to the superposition of crest and trough in the configurations. Again as Schrödinger considered the transition of electrons to different energy levels as a change of frequency in a standing wave, then so too the transformation of nuclei in various nuclear processes of decay and reactions.

If force is a relational concept linking mass and motion then although useful and instrumental, cannot be hypostatised as Newton made clear. While the particle theories need to cling onto this concept, it is superfluous in wave mechanics.

Conclusions

It is difficult not to view these early concepts as linked to the ancient Greeks and Romans, especially Ovid's Metamorphoses describing transformations from chaos into order and the gods, like energy, immortal (conserved) but changing form at will. The underlying concept is a fluidity in Nature which I believe is best described by waves. The proponents of the particle view of phenomena struggle at every turn with logical and ontological problems. Their resistance to wave mechanics over the decades is baffling.