Mpantes, J Powder Metall Min 2017, 6:1
DOI: 10.4172/2168-9806.1000157

Journal of
Powder Metallurgy & Mining
ISSN: 2168-9806

Short Communication OMICS International

The Quantization of Space and Time

Mpantes G*

Department of Mathematics, Aristotle University of Thessaloniki, Greece

Abstract

Every orbit of a material particle is composed of a finite number of parts of space lengths and time durations which depend on the particle's momentum and energy. These are the "point" and the "moment" in space and time respectively. The uncertainty principles are attributed to the space-time through the physicisation of the geometrical concept of "point". This new interpretation of uncertainty principles derives new conclusions in wave theory. The results of the discontinuity of space time, gives a new meaning in the foundations of quantum mechanics. These results are the new interpretation of photon, of matter waves and complementarity, Bohr's postulates, as mathematical conclusions in the bases of Calculus.

The Quantization of Space Time

The two principles that express in qualitative terms the axiomatic basis of quantum mechanics viz. the uncertainty principle and the complementarity principle are in some way metaphysics. The disappearing of causality in atomic field and the limitation on the classical concept that the behaviour of atomic systems can be described independently of the means by which they are observed, must be explained in a more physical sense through the matrix of all the descriptions: the space-time.

Uncertainty Principles, Photon Matter Waves and Geometry

In this paper we shall attribute a physical sense to the "event" of flat space-time: The point in space and the instant in time. Having linked the geodesic of space-time with the orbit of a free body, it follows that our proposed interpretation of the concepts point in space and instant in time will be related to bodies and their motions. Thus, if (ε) is the cosmic line of a body between the events $A_1(x_1,t_1)$ and $A_2(x_2,t_2)$, we accept that the distance x_2-x_1 is equal to a finite number of "points" each of length S_q=h/p, where h is Planck's constant and p the momentum of the body, namely:

$$x_2-x_1=n\ h/p. \quad (1)$$

Furthermore, the difference t_2-t_1=n h/E, (2)

Where E is the energy of the body/particle and t_q=h/E the "instant" in time of the course of the body.

The material body cannot trace an orbit of less than S_q and the description of its behaviour is limited temporally by t_q to durations longer than t_q. These two quantities are the point and the instant of the specific cosmic line. So the existence and the trajectories of the material particles are not continuous.

From eqns. (1) and (2), the quantification of the action follows naturally, since Action=(energy) × (time), so:

$$Action=E.nt_q=nh\ n\varepsilon N \quad (3)$$

Uncertainty relations

The physical existence of the "point" of space-time will give a new meaning to the uncertainty principles. It is known that any measurement of a physical magnitude causes an alteration in the state of the system in which the measurement takes place. In particular, the disturbance caused to a microcosmic system is not negligible.

This disturbance is caused by the application of a force F on the system, which will act for a spatial interval Δx and time interval Δt. These intervals cannot be as small as we wish: it is in this that the differentiation with classical science is manifested. $\Delta x=nS_q$ and $\Delta t=n't_q$, however accurate the experimental conditions are. However, Δx and Δt are fully undefined, since the parameters p and E of eqns. (1) and (2) are unknown. Therefore the force F, applied for a finite time and space interval will cause a change in the momentum and energy of the body in accordance with the formulae:

$$\Delta p=F\ \Delta t. \quad (4)$$

$$\Delta E=F\Delta x. \quad (5)$$

Where the alterations Δp and ΔE are for the purposes of the experimental measurement the uncertainties concerning the measures of momentum and energy, since Δx and Δt are undefined. That is to say that the uncertainties are unquantifiable alterations.

On eliminating F from eqns. (4) and (5) we have

Δp.Δx=ΔE.Δt, and, since every element of this relation has dimensions of action, we have:

$$\Delta p.\Delta x=\Delta E.\Delta t=nh. \quad (6)$$

The new meaning of this relation is that since the point in space and the instant in time have acquired dimensions, the uncertainties of eqn. (6) express the discontinuity which space-time attributes to the history of bodies. However, their interpretation extends beyond experimental measurement.

ΔE.Δt ≥ h can be interpreted as follows: The alteration of energy by ΔE cannot take place instantaneously, but in some finite time n.h/ΔE. The least time in which this can occur is Δt=.h/ΔE. For example, the "most rapid" energy alteration by ΔE can be described as follows: at instant t_1 we have energy E and at $t_2=t_1+h/\Delta E$ energy E+ΔE. For the interval t_2-t_1 the law of conservation of energy is violated, but is restored at instant t_2. Similarly the alteration in momentum by Δp requires an

***Corresponding author:** Mpantes G, Department of Mathematics, Aristotle University of Thessaloniki, Greece, Tel: +30 2310 997950; E-mail: mpantes_2@yahoo.gr

Received February 03, 2017; **Accepted** April 25, 2017; **Published** April 29, 2017

Citation: Mpantes G (2017) The Quantization of Space and Time. J Powder Metall Min 6: 157. doi:10.4172/2168-9806.1000157

interval [in order] to occur. The smallest interval is h/Δp. This is the "point" of alteration of momentum, in the same way as h/ΔE is the 'instant" of alteration of energy. These alterations are not continuous.

The Results in Wave Theory

This new interpretation of the uncertainty principles leads to two significant conclusions in the field of wave theory. We can give a new expression for the quantity of energy which is emitted out by the wave over a period and for the amount of momentum in a wavelength.

Let A be a point in the space of propagation of a wave and E_π be the energy which appears over a period T. Then, from eqn. (6) for $\Delta E=E_\pi$ and $\Delta t=T$ we have:

$$E_\pi \geq hv. \quad (7)$$

Namely, the energy of the wave over a period is quantized from hv and thus acoustic phonons are considered to correspond to sound waves. Also from eqn. (6) we have

$$p=n\ h/\lambda=nhk, \quad (8)$$

Namely, we correspond momentum with phonons, where k is the wave number of the wave. The relations eqns. (7) and (8) are valid for any wave with the elements v, λ and u. These relations will be of use to us in further calculations.

The photon

In what follows we shall interpret the particle nature of light. It will be shown that its particle behaviour must be attributed to space-time. The uncertainty relations which follow from the physical definition of the space-time point will provide a basis for the consideration of the photon. At a point A in the space of propagation of electromagnetic radiation we have the appearance of a given energy E=ΔE over a period T=Δt. It follows from eqn. (6) that,

$$E=nh/T=nhv. \quad (9)$$

However, if we consider that this alteration of energy E over a period is the most rapid that can occur in nature, then it follows from eqn. (9) that E=hv, i.e. that the energy per period is hv. Its action is revealed discontinuously, despite the continuous nature of its alteration, since in a lesser time (one period) the principle of conservation of energy is violated: "the instant of alteration is the period". Thus at the conclusion of each period, the quantity of energy hv is appears to the interactions, giving a basis to the discontinuity of the emission of the beam of light, the particle behaviour of light (the photoelectric phenomenon). This image exists at every point of the emission of light. Consequently, the "phenomenon" is propagated at a velocity of c, namely we have the emission of energy hv over a period supplied continually by the propagation of the wave (photon). This image tells us that the photon does not have the same physical basis as the material body which is in motion from point to point. One photon exists in one place and another in another. The photon is an operation of space-time: the continuous variations of the electromagnetic field are converted by space-time into the discontinuous emission of a quantity of energy hv towards the environment. Certainly the propagation of the phenomenon which causes the discontinuous emission of the light beam is equivalent in description to the displacement of the quantity of energy hv, and therefore with the translation of momentum p=h/λ. Now the particle reality is complete. Photon is the microscopic description of Maxwell waves.

Matter waves, complementarity

Are particles really waves? In the early experiments the diffraction patterns were detected holistically by means of a photographic plate, which could not detect individual particles. As a result the notion grew that particle and wave properties were mutually incompatible, or complementary, in the sense that different measurement apparatus would be required to observe them. That idea, however, was only an unfortunate generalization from a technological limitation. Today it is possible to detect the arrival of individual electrons, and to see the diffraction pattern emerge as a statistical pattern made up of many small spots. The manifestations of wave like behaviour are statistical in nature and always emerge from the collective outcome of many electron events. On the other hand why pattern happens to be one that is consistent with wave interference? The single detection events are indeed consistent with the particle nature of electron but the interference pattern must be explained exclusively in terms of particle physics if one wants to deny the wave nature of the electron, another physical model is necessary. That model is the quantization of space as we described in matter waves. This is the corresponding with quantization of time which gives the origin of photon.

An attempt will now be made to describe the motion of a particle in S_q.

S_q is not a distance in the orbit of the body, and therefore is connected to the time t_q. Consequently its velocity must be c^2/u, a fact which destroys the particle image (description).

The restoration of the description is performed through eqn. (8).

The momentum translated by a wave is p=h h/λ and the smallest momentum of the wave is:

$$p=h/\lambda. \quad (10)$$

Comparing eqn. (10) with eqn. (11), it can be seen that the momentum of a body is equal to the momentum of the wave of wavelength $\lambda=S_q$. The identity of the descriptions becomes an essential identity, since reality is attributed through the time-space description. As it is impossible to describe motion within S_q with particle characteristics, then the body is described viz. becomes a wave which appears for distances compatible with S_q and whose characteristics are λ=h/p, a velocity of C^2/u and $T=t_q$. This is Broglie's material wave. From this the wave-packet which has a Group velocity of u, is constructed. Thus the acceptance that the space-point and the time-instant have dimensions produced the wave nature of matter as the only possibility of description. The discontinuity of space time is the basis of quantum mechanics. The results of the experiments involving the collisions of electrons with matter, were easily explained using the Broglie's ideas, and could not be explained otherwise. A more physical explanation is the quantization of space-time.

The old quantum theory: Bohr's postulates

In old quantum theory, the circles in which the electrons might move are restricted. Here, Bohr introduced his first postulate which predicted exactly which circles are permitted for the electron motion. The quantization condition is that circular trajectory of a particle is an integral number of "points" with the property of space quantum S_q viz.

$$2_\pi r=nh/p. \quad (11)$$

A circle in geometry is a set of points with the property of eqn. (11)

Also (the second postulate) the discrete radiation emitted by an atomic system was the result of atoms going from an excited stationary state to a less excited stationary state. The frequency of the radiation emitted, is found from the relation

E_2-E_1=hν which connects the alteration of electromagnetic energy with the period of time to occurs, as we say in the new interpretation of the uncertainty principles. In microcosm the dimensions of points and instants are revealed.

Other Conclusions: Zenon's Paradoxes, the Mathematical Continuum

An extension of these ideas lies in the relationship of the motion of bodies, and the mathematical description of this relation. The paradoxes of Zeno due just to the transport of data of motion in numbers-the points of the continuous straight-now not undergo. The path AB of the paradox of dichotomy (Article: paradoxes of Zeno mpantes on scribd) consists of finite though very large number of mobile spatial steps, which are over, and the body reaches B. The mathematical infinity is separated of the physical motion, as was everywhere in every branch of physics. So the mathematical description becomes a map of traffic, with scales etc., But as we know, the maps do not describe the motion, but the path of the motion. In classical mechanics, the differential causality of calculus is an accurate approximation of motion, because for the bodies of our direct experience, the spatiotemporal quanta tend to zero, yielding the concept of infinitesimals of Leibniz. The concept of the mathematical continuum that followed refers in numbers, which we considered as images of every reality, even of motion. So we remained Pythagoreans for many centuries, believing that "everything is number." The limits of Cauchy, the continuum of Dedekind and Cantor are mathematical discoveries about numbers, so they do not mean anything about the nature, apart from catalytic simulation and approach succeeded.

Citation: Mpantes G (2017) The Quantization of Space and Time. J Powder Metall Min 6: 157. doi:10.4172/2168-9806.1000157