Physical explanation of wave-particle duality

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Summary

We propose a Physical explanation of duality by considering two new concepts, namely that every elementary Particle is made up of a more or less complex stationary wave (2) and that Empty Space is a granular medium comparable to a fluid quantum (3). The corpuscle can then be considered as a vortex of this medium, which implies a relationship of balance between the two entities, the wave is then the reaction of the medium to the presence of the vortex, or vice versa. This interpretation is compatible with quantum and relativistic theories and is in accordance with the results of loop theory (4) with regard to Space.

Introduction

The wave-particle duality is the basis of Quantum Mechanics, it is a century old and, very paradoxically, has not yet received a satisfactory interpretation. The cause is that, since the discovery by Louis De Broglie (1) of a "wave character" to elementary Particles, this subject was quickly overtaken by the development of the operational formalism of the new mechanics. David Bohm, taking up an old idea from Louis De Broglie (5) had constructed a deterministic quantum theory by

giving a certain physical meaning to this wave which then becomes a guide for the Particle; the wave-particle duality is then conceived by a necessity of phase agreement between a wave in Space and an obscure internal periodic mechanism of the particle. The purpose of this publication is to clarify this mechanism in a conceptual progression on the structure of elementary particles and the constitution of Space.

Corpuscles, Space and their interdependence

Quantum physics makes no particular hypothesis on the internal structure of particles, only the wave functions, to which they are subject, have operational importance. Space is considered as a superposition of fields of which the Particles are the sources or the consequences (…). An elementary Particle such as the Electron is located as the source of the electromagnetic field in a "mathematical point". The "wave" character is attributed (mathematically) only to Space by the specific wave functions which define all quantities in terms of probabilities In (2). We describe the Electron as a real standing wave of decreasing amplitude which is one of the solutions of Maxwell's equation. We access the formula giving its mass by normalizing its amplitude by the analysis of its internal angular momentum and by an hypothesis about its interaction with Space, assimilated to a quantum fluid (*), see (3).

Like any quantum fluid, this Space is made up of interactive elementary grains which form a whole managed by a wave function. The numerical interpretation of Newton's formula giving the attractive force between two masses leads to attribute to the elementary grains an extremely low energy and dimensions (see 2) which are, moreover, two perfectly indivisible quantities, they constitute the messenger particles of this force in their dynamic state which we call "graviton" (see 3). The gravitons are generated by the equilibrium interaction between the corpuscles and the medium constituting empty Space in the form of the periodic exchange of the elementary action **h** between this medium and its Vortex (corpuscle) whose rotation period is identical, see (2)

Elementary grains are, of course, the constituents of empty Space as well as corpuscles, their movement is linear in the first case (graviton) and closed periodic in the second (standing waves).

The "Wave" part

If the corpuscle is stationary (fixed particle), the previous equilibrium reaction imposes a resonance of the adjacent Space according to the "action/reaction" principle. The resulting wave, which is also the phase field of the particle, has the period of movement of the vortex and an amplitude proportional to the density of gravitons.

The uniform displacement of the corpuscle-vortex causes a progressive shift in the phase of the wave, it thus constitutes a new wave which is the De Broglie guide wave. It is interesting to compare this description to the author's development in his doctoral thesis (1) on the phase wave, see also the justification of the wavelength **(= h/p)** in a work on physics waves (6).

Duality

We have shown the close and necessary relationship of the corpuscle-vortex (standing wave) and its reactive wave (phase field) to form an elementary Particle, this natural association explains the double aspect, complementarity and duality. The two entities, which appear very different in classical physics, thus constitute one and the same excitation of the quantum fluid constituting the Universe; this is the elementary Particle.
The trajectory of the corpuscle is then totally subjected to all the "external" interactions of its wave, which confuses it, in some way with it, thus explaining the complementarity.

Conclusion

According to this view, it is not difficult to understand why duality has remained so mysterious; the mathematical formalism and abstraction of quantum mechanics prevented us from following up on the presumptions of Einstein, De Broglie and Schrödinger who sought true Knowledge. The very

concrete interpretation that we have given can be a beginning towards a theoretical completion which will have to integrate the force of gravitation into the quantum reality of the microscopic world; the relationship between the phase wave and the graviton flow goes in this direction. We must also hope for an understanding of the entanglement ; let's say here that the creation of two perfectly twin "Particles" must generate a phase field common to both, which can reduce them to a single Particle composed of two corpuscles...

(*) What we call "quantum fluid" is a medium where the constituent particles have their quantified quantities in common (energy, angular momentum, etc.), for example Bose-Einstein condensates, super-fluid Helium where "cold atoms"

Références

Reference **1** : Louis de Broglie ; *Recherche sur la théorie des Quantas.* Masson, 1963 ; réédition de la thèse de doctorat

Reference **2** : YC Raverdy ; *A formula for electron mass calculation based on new fundamental concepts ,* viXra , Hight Energy Particles Physics 22/08 - 0154 , Journal of Pure and Applied Mathematics, Vol 7, No 2, March 2023

Reference **3** : YC Raverdy ; *A Corpuscular Space-Time to explain Gravitation ,* viXra , Quantum Gravity and String Theory 23/03 – 0024 , Journal of Modern and Applied Physics, Vol 6 , No 2 June 2023

Reference **4** : Carlo Rovelli, Sciences et Avenir , interview , 212, Jan. March 2023

Reference **5** : David Bohm Quantum Theory, 1951, Prentice hall, 1989 reprint, New York: Dover (ISBN 0-486-65969-0)

Reference **6** : Michel Soutif, Vibrations, Propagations, Diffusions, Dunod, 1970.