Alternative to the Probabilistic Interpretation of Wave Function ψ. Experimental Confirmation of the Realty of de Broglie's Pilot Wave

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Abstract. While the mathematical formalism of quantum mechanics describes many experiments well, there are heated discussions among scientists about its physical interpretation. The causal interpretation of quantum formalism centers around the existence of 'non-local hidden variables', allowing a quantum system to be consistent with the deterministic theory. Well-known scientists Louis de Broglie', David Bohm and Jean-Pierre Vigier were proponents of the causal interpretation of the quantum theory. A number of recent experiments provide new arguments in favor of the causal interpretation. Among these experiments stand out the double-slit experiments performed by Menzel et al.: [1] PNAS June 12, 2012, vol. 109, no. 24, 9314-9 319, and [2] Journal of Modern Optics, 60:1, 86-94 (2013). The results of these experiments were analyzed in Antonio Cardoso's work "The reality of de Broglie's pilot wave" [Annales de la Foundation Louis de Broglie, Volume 41, 2016]. These results confirm the existence of 'non-local hidden variables' which can be a new physical field. Obviously, the causal approach gives a new physical meaning to the Schrödinger Equation and the wave function ψ. These ideas are further developed in my article "The Schrödinger equation from the viewpoint of the theory of hidden variables". [Proceedings of the Xth Symposium, honoring J.-P. Vigier, Italy, July 2016, *Unified field mechanics II*, Sotina Nina, pp.292-297].