The David Bohm pilot-wave interpretation is the best approach to Reality of Quantum Physics

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The problem with introducing the particle trajectories into Quantum Physics is the need of the violation of the Energy Conservation law. The latter law must hold, because the Noether's theorem requires it for the case of homogeneous time. Therefore, the wonder is happening, provided, that the David Bohm's theory is proved. But latter proof is there, in [M. Ringbauer et al.: Nature Physics, 2015] together with my explanation in the present manuscript. Enjoy!

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The present work is motivated from the recent paper arxiv.org/pdf/1412.6213v2.pdf, which is also presented in the most famous journal – "Nature" and discussed in [1].

Because a photon is the relativistic particle, his square of the wave-function $\psi\,\psi^*$ can be negative (can it?), thus it is not the probability-density to find the photon in given place. That is why the Ringbauer do not use the formula $\mu = \psi\,\psi^*$, but simply talks of the statistics of possible measurement. As I have understood the authors idea can be seen as following. We have measured the system configuration λ at time $t = fixed$. Thus, we are like the "Laplace Demon" do know the positions of all the parts of the system. Secondly, we do know the two possible wave functions ψ and ϕ. Can we guess the right one, the one which the system actually obeys at t?

The Ringbauer has discovered the amazing fact, what classical probability to distinguish between ψ and ϕ is better, than the quantum one. Therefore, the classical interpretation of the quantum physics (the wave function is just our unawareness of the true trajectories of the particles, like the David Bohm understood) is better description of the nature, than the other possibilities.

The quantum measuring device is the apparatus, which measures the quantum wave function directly. Such device does not exist. Do you agree? Yes, but one can solve Schrödinger's equation for given conditions and get it to know. Therefore the text in the Theorem 2, page 2 (http://arxiv.org/abs/1310.8302v1) does make sense, however is very funny.

The inequality $P_Q < P_C$ naturally holds, because looking at the Fig.1.a one can find such optimal λ for optimal measurement to distinguish ψ and ϕ with best chance. I have understood, what

$$\langle\psi|\phi\rangle = \int \psi\,\phi^*\,dx\,dy\,dz\,,$$

where $\psi = \psi(t, x, y, z)$, $\phi = \phi(t, x, y, z)$.

[1] M. Ringbauer et al., "Measurements on the reality of the wavefunction", Nature Physics, 2015: "Wave function gets real in quantum experiment" in newscientist.com; "Simultaneous observation of the quantization and the interference pattern of a plasmonic near-field." Nature Communications, 2 March 2015; "First photograph of light as both a particle and wave" (physicsforums.com, Phys.org)