



SDI Review Form 1.6

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| Journal Name: | Physical Science International Journal |
| Manuscript Number: | 2015_PSIJ_18414 |
| Title of the Manuscript: | THE COMPUTATIONAL LIMIT TO QUANTUM DETERMINISM AND THE BLACK HOLE INFORMATION LOSS PARADOX |
| Type of the Article | Original Research Article |

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PART 1: Review Comments

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| | Reviewer's comment | Author's comment <i>(if agreed with reviewer, correct the manuscript and highlight that part in the manuscript. It is mandatory that authors should write his/her feedback here)</i> |
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comments

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The theoretical reasoning of the author(s) is clear.
However, it seems to me that an essential point has escaped him. In quantum physics, there is always an interaction between the physical value of the system and the instrument measuring, which leads to crossed terms (entangled terms).

When the initial state of the system is represented by a function of state unspecified, the linearity of Schrödinger's equation has as a consequence that the final state is represented by a formula which does not contain a cross term.

In this case, the reasoning of the author(s) is exact.

However, in the quantum theory of measurement, cross terms generally appear when one is interested in the average value of observable pertaining to the unit "system + instrument".

These cross terms appear if one adopts the formalism of the Heisenberg's matrix density. It results from it that in the final state of the unit "system + instrument", the needle of the instrument does not have, in each case, a statistical position.

In other words, the breakdown of determinism only based on the wave function cannot be defended here as potentially serious. Taking into account these arguments, the author(s) should at least discuss these points.

The Reviewer made the important point regarding the relationship between the Schrödinger equation and wavefunction collapse (e.g., as a result of the measurement on a system), which was missed in the initial version of the paper.

Indeed, in the Copenhagen interpretation, there are two different postulates for the evolution of the same mathematical object – the wave function of the system. While in most cases, the wave function evolves gently, in a perfectly predictable and continuous way, according to the Schrödinger equation; in some cases only – as soon as a measurement is performed, unpredictable changes take place, according to the postulate of wave packet reduction.

However, the advent of quantum decoherence theory allowed alternative approaches (such as the Everett many-worlds interpretation and consistent histories), wherein the Schrödinger equation is always satisfied, and wavefunction collapse should be explained as a consequence of the Schrödinger equation.

Thus, if we insist that not only a deterministic, unitary evolution but also a wavefunction collapse should be explained due to the Schrödinger equation, then the future state of the system would always be uniquely determined through the linear map, i.e., through the quantum deterministic principle. Between these lines, the breakdown of determinism would mean the failure to provide the future state of the system based on the solution of the Schrödinger equation, which is main point of the paper.



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| <u>ODI Review Form 1.6</u> Multiple comments | | I am very grateful to the Reviewer for the time the Reviewer spent thoroughly reading my paper and the valuable suggestion helping to improve the paper. |
| <u>Optional/General</u> comments | | |