Second, the classical algorithm is performed on $|x\rangle$, using the sequence of quantum measurements. This is possible because the quantum system is modeled by a classical algorithm which can simulate the quantum system. The quantum state is updated after each measurement, and the algorithm continues until a certain condition is satisfied.

Classical Chaos

Comment on Single Quantum Computation of Unstable
simple classical gates each being the classical equivalent of the quantum gates in the Letter's quantum algorithm. With perfect gates this leads to $i', j'$. Third, we read out (trivially) the contribution of the result to the phase-space density in the final state. Obviously, this contribution will be of the same statistics which we would have obtained in quantum quantum measurements of observables (2) after quantum computation (1). No one could distinguish between the data taken from the quantum or from the classical computers, respectively.

This equivalence remains valid if the coarse-grained or the Fourier-transformed version of set (2) is analysed. Furthermore, the equivalence survives if logical gates are not perfect. Assume you have a classical computer to perform the map $i, j \rightarrow i', j'$, using simple reversible gates. And imagine that, at your alternative wish, you can run the same gates coherently. This is how the Letter's quantum algorithm can be related to the classical one. I have already proved that the coherent and incoherent runs give the same statistics for the classical Arnold map, provided the gates are perfect. If they are not, we can still assume that the bit-error rates are independent of whether we run the gates coherently or not [4]. Hence the quantum and classical computations will be equivalent for nonideal gates, too. (The gates' phase errors do not influence the results of the quantum protocol.)

For the classical chaotic evolution, the claimed advantage of the Letter's quantum algorithm is illusory. It has disappeared when we have concretized the statistical analysis, left undetailed by the authors, of the final quantum state.

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Lajos Diósi
Research Institute for Particle and Nuclear Physics
H-1525 Budapest 114, POB 49, Hungary

[2] The quantum Fourier transform, barely mentioned in [1], is non-diagonal. It yields the classically irrelevant power spectrum of the wave function $a_{ij}$, not the classically relevant harmonics of the Liouville density $|a_{ij}|^2$. For detailed criticism see Ref. [5].
[4] The Letter assumes different errors for quantum and classical gates, for detailed criticism see Ref. [5].