Abstract Submitted
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**Parallel Environment for Quantum Computing**[1] FRANK TABAKIN, University of Pittsburgh, BRUNO JULIA DIAZ, Universitat de Barcelona — To facilitate numerical study of noise and decoherence in QC algorithms,and of the efficacy of error correction schemes, we have developed a Fortran 90 quantum computer simulator with parallel processing capabilities. It permits rapid evaluation of quantum algorithms for a large number of qubits and for various "noise" scenarios. State vectors are distributed over many processors, to employ a large number of qubits. Parallel processing is implemented by the Message-Passing Interface protocol. A description of how to spread the wave function components over many processors, along with how to efficiently describe the action of general one- and two-qubit operators on these state vectors will be delineated.Grover's search and Shor's factoring algorithms with noise will be discussed as examples. A major feature of this work is that concurrent versions of the algorithms can be evaluated with each version subject to diverse noise effects, corresponding to solving a stochastic Schrodinger equation. The density matrix for the ensemble of such noise cases is constructed using parallel distribution methods to evaluate its associated entropy. Applications of this powerful tool is made to delineate the stability and correction of QC processes using Hamiltonian based dynamics.

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