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Exact Dynamics via Poisson Process: a unifying Monte Carlo paradigm JAMES GUBERNATIS, Los Alamos National Laboratory — A common computational task is solving a set of ordinary differential equations (o.d.e.'s). A little known theorem says that the solution of any set of o.d.e.'s is exactly solved by the expectation value over a set of arbitary Poisson processes of a particular function of the elements of the matrix that defines the o.d.e.'s. The theorem thus provides a new starting point to develop real and imaginary-time continous-time solvers for quantum Monte Carlo algorithms, and several simple observations enable various quantum Monte Carlo techniques and variance reduction methods to transfer to a new context. I will state the theorem, note a transformation to a very simple computational scheme, and illustrate the use of some techniques from the directed-loop algorithm in context of the wavefunction Monte Carlo method that is used to solve the Lindblad master equation for the dynamics of open quantum systems. I will end by noting that as the theorem does not depend on the source of the o.d.e.'s coming from quantum mechanics, it also enables the transfer of continuous-time methods from quantum Monte Carlo to the simulation of various classical equations of motion heretofore only solved deterministically.

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