A Density Matrix Renormalization Group Approach to Non-Equilibrium Phenomena.

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The Density Matrix Renormalization Group (DMRG) [1, 2] is a technique for the selection of the relevant degrees of freedom of complex systems, based on an appropriate sequence of consecutive splittings and gluings of the system into unequal parts. Each part is always represented by a small number of degrees of freedom which, along with some information about the interaction, allow us to reconstitute approximately the whole physics of the system.

It was originally developed in 1992 by S.R. White [3] using quantum mechanics as a toy model, but its applicability to many-body physics constitutes its main attractive feature. Nowadays, it has been applied to a great variety of strongly interacting systems, such as the Heisenberg or Hubbard models, phonon systems, disordered systems... See [4] for a recent review. T. Nishino and his group extended the algorithm to work with classical equilibrium problems, supported on the idea that a classical 2D partition function is mathematically equivalent to a 1D quantum many-body system [5].

The same mathematical equivalence may be extended so as to allow us to deal with non-equilibrium systems [6]. We shall show, assuming no previous knowledge on DMRG, how it may be applied to, e.g., reaction-diffusion systems and similar models. The technique provides us with ensemble averages for a wide class of observables. It has several advantages against pure Monte-Carlo techniques because, at each step, the system is made up *only* with our current approximation to the relevant degrees of freedom of the system.

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