A numerical simulation of the Ehrenfest model of diffusion

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Abstract: I present here a code for the Ehrenfest model of N particles in two containers. The code is written in C++ and parallelized using OpenMP. The parallelization is of iteration and not the simulation. I was able to evolve the state of the particles to a Poincare' cycle in modest time. For a system of 28 particles, the code ran 100 iterations in 26.28 minutes using 16 threads and measured an average Poincare' cycle of 2.518×10^9 steps. The code is available from it's master online repository: `http://github.com/gLENTNER/EhrenefestModel.git`

Key words: methods: numerical, statistical

1 Description

The code is written in C++ and follows an object-oriented design pattern. The primary simulation routine is encapsulated inside a *Model* class. This object takes information from a parsing routine about the environment of interest (e.g., number of particles) and follows a system from its initial state until either a Poincare' cycle or equilibrium has been reached, whichever occurs last. The structure of the code is depicted in Figure 1

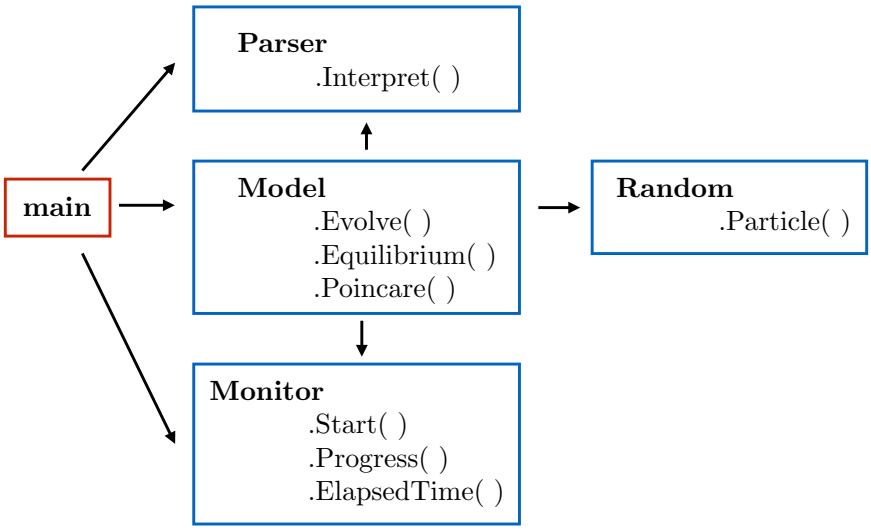

Figure 1: Above is a simplistic structure diagram of the code. The elements bordered in blue are part of the