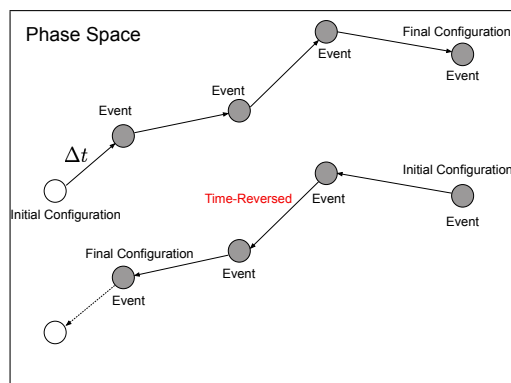


# Computational exercise: Testing for Time Reversal in a system of Hard Disks

This simple exercise tests for Time Reversal Symmetry in a system of hard spheres (disks in 2D) confined to a square box, using the event-based algorithm. For definiteness, take a system of only four disks, with density (defined as fraction of the area of the box occupied by the disks) of about 0.4. Give the disks any initial position and velocity (make sure there are no overlaps). Run the algorithm for different number of events. For a given number of events, store the final positions and velocities, reverse the velocities, and run the algorithm again taking this to be the initial configuration. This will implement time-reversal. Check if the final positions and velocities are consistent with time-reversal symmetry. You need to take care of the following: the starting configuration does not constitute an ‘event’. After evolving this for a certain number of events, the final configuration ends up as an event. When the velocities are reversed and the algorithm is run again, it will end at an event, *not* the initial configuration.



Therefore, for the initial configuration, the time upto the first event needs to be calculated and stored, and the time-reversed configuration needs to be additionally evolved for this duration. Observe what happens as the number of events is progressively increased.