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HW3: Computational Physics

In general, I chose to run the simulations with
- Nt = number of timesteps = 200
- L = size of box = 1 (square box)
- Epsilon = 0.5 (to update the timestep)

Moreover, the plots are produced using a "reflective" boundary condition. The function to change to a "periodic" boundary condition was created and can be used by updating the initial variable *boundary_condition* to the keywork "periodic".

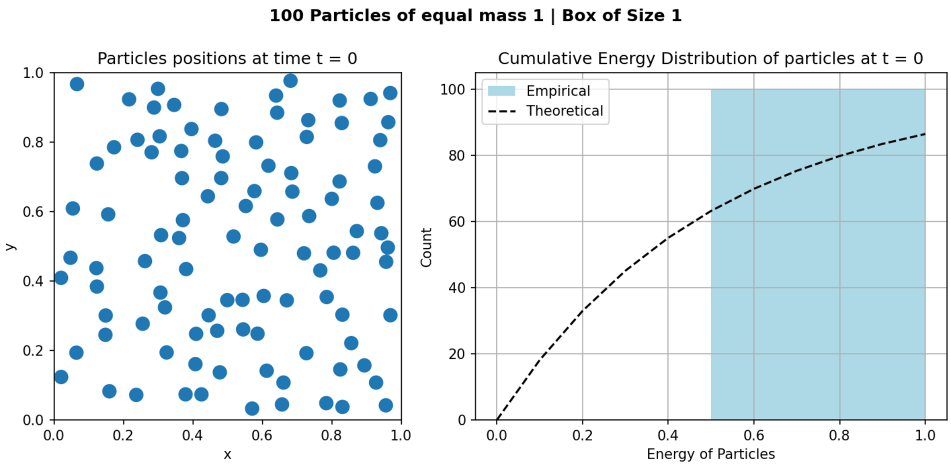
Additional explanation about the code can be found as "comments" in the Jupyter notebook.

Case 1

- 100 particles
- All particles have
  - non-dimensional mass of 1
  - initial velocity of 1
  - radius of 0.02 (2% of the box size)

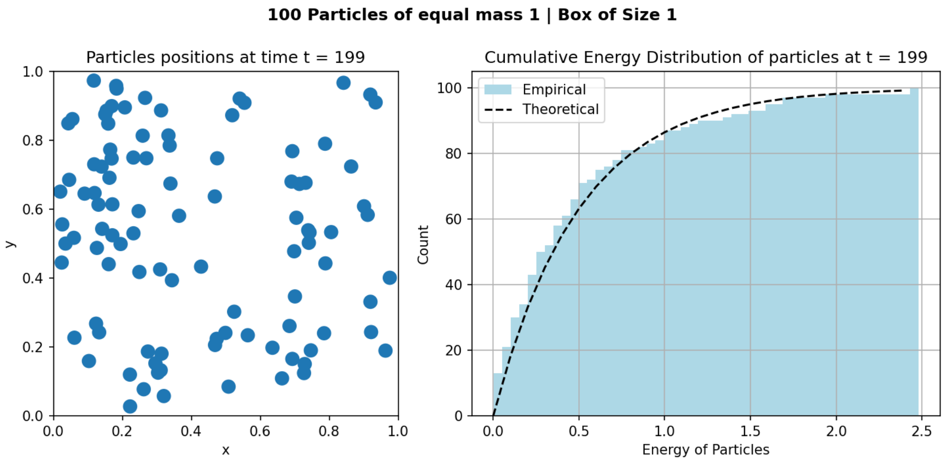
<u>Initial state</u>

The dashed line represent the 2D Maxwellian distribution.



<u>Final state</u>

The final animation is stored in the file "case_1/ animation_case_1.mp4"

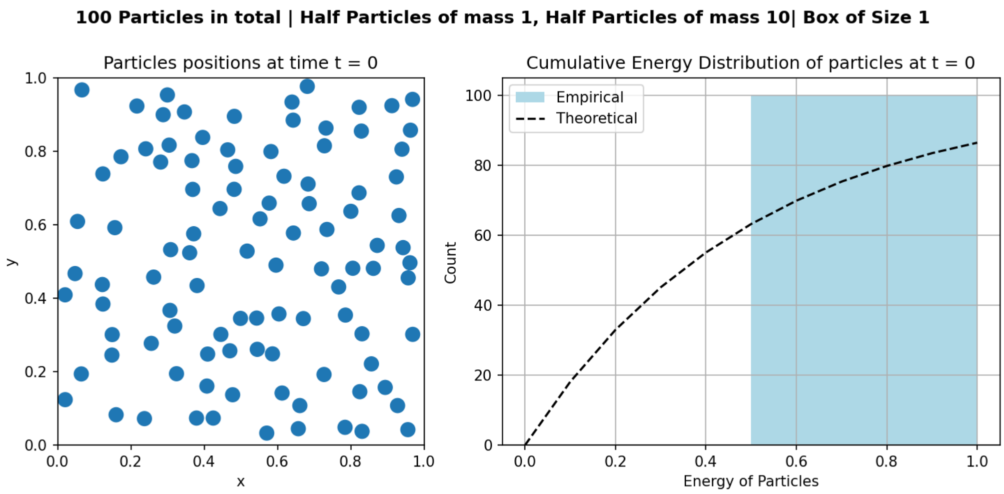


Case 2

- 100 particles
- half of the particles have a non-dimensional mass of 1 and initial non-dimensional velocity of 1
- half of the particles have a non-dimensional mass of 10 and initial non-dimensional velocity of sqrt(1/10)
- all particles have a radius of 0.02 (2% of the box size)

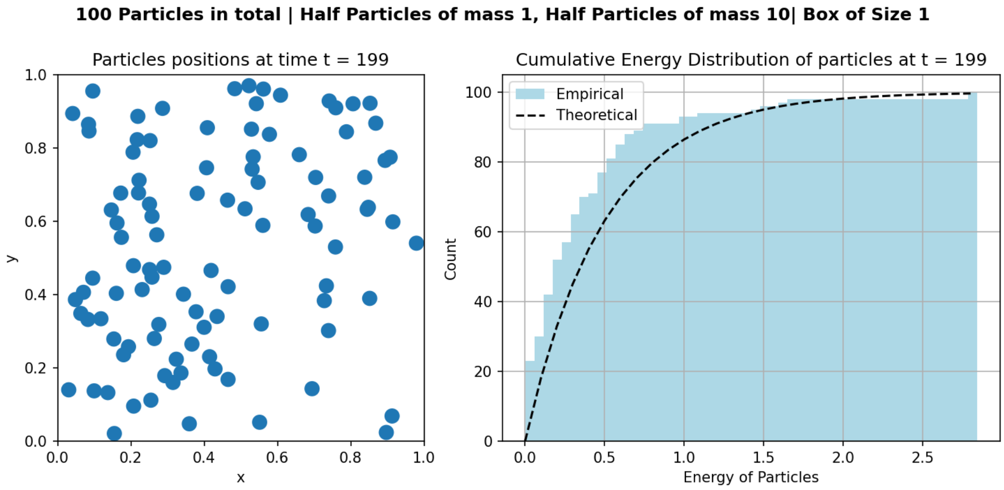
<u>Initial state</u>

The dashed line represent the 2D Maxwellian distribution.



<u>Final state</u>

The final animation is stored in the file "case_2/ animation_case_2.mp4"



Discussion

It seems that when all particles have a non-dimensional mass of 1, the energy distribution follows a Maxwellian distribution (case 1). However, when half of the particles have a mass 10 times higher, there seems to be more particles with lower energy (as it can be seen on the last plot, case 2).