Homework 3, Living Crystals

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9.1: a, b (v change)

500 iterations for every run in 9.1.

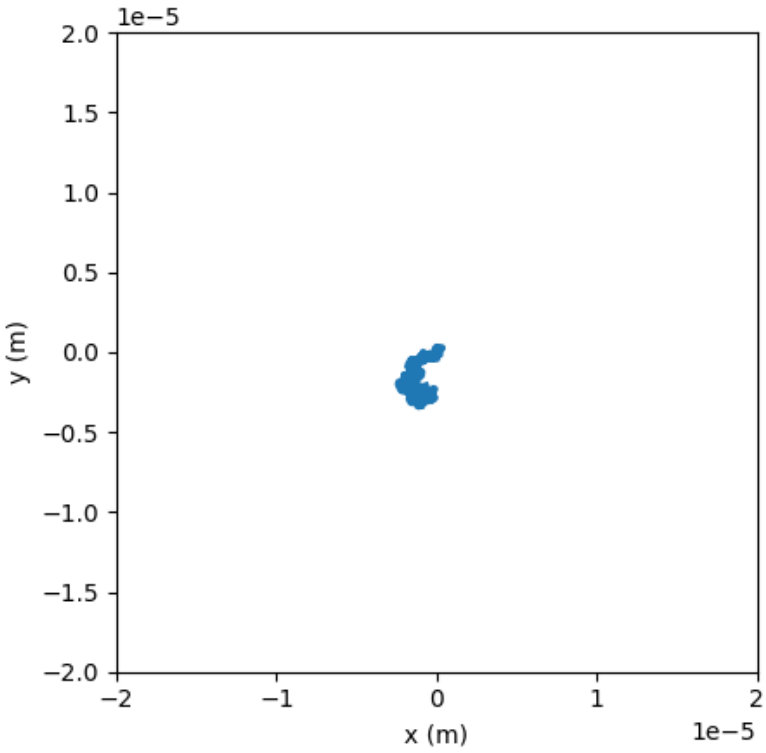

Figure 1: $v = 0$, $D_R = 5$ and $D_T = 8e - 14$.

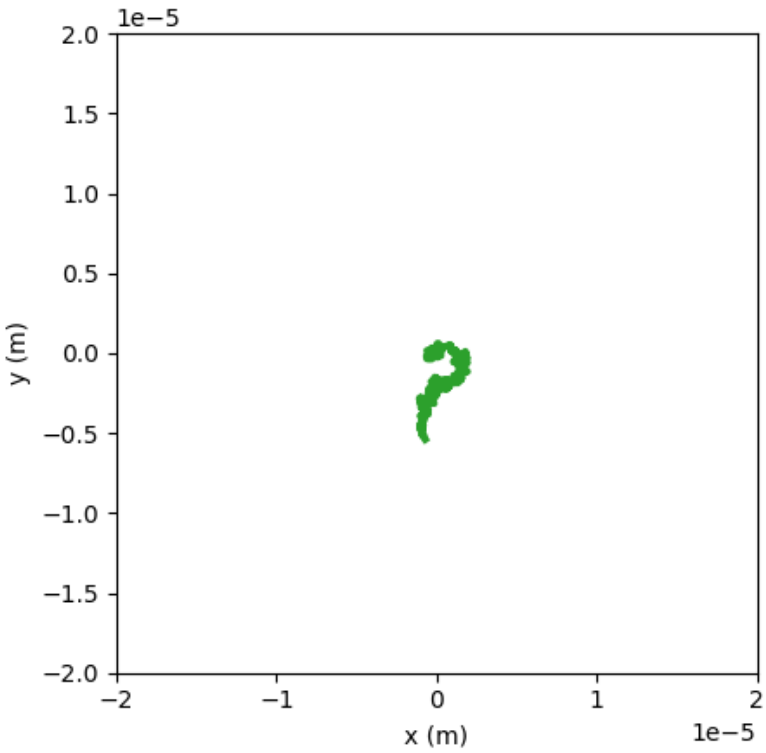

Figure 2: $v = 1e-6$, $D_R = 5$ and $D_T = 8e-14$.

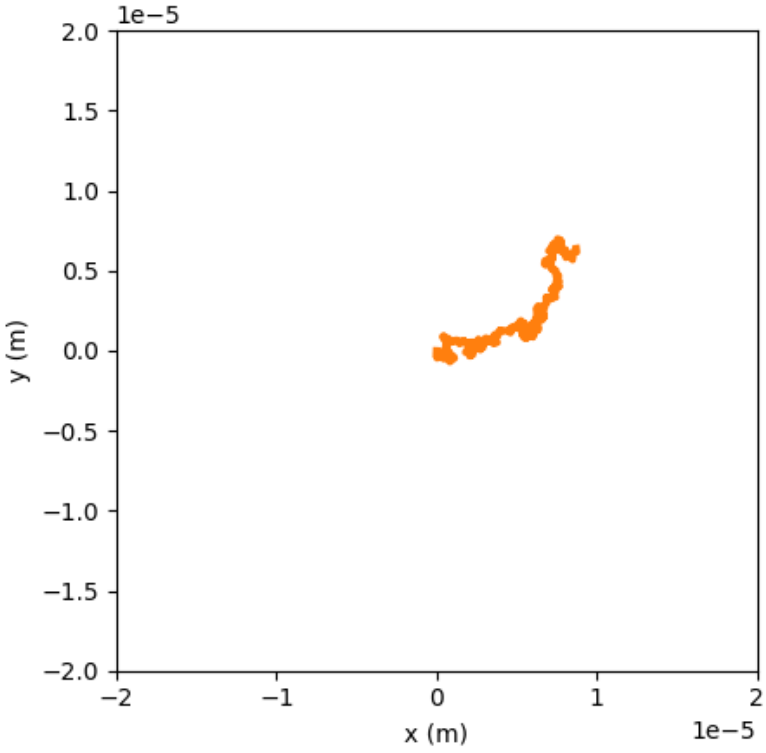

Figure 3: $v = 2e-6$, $D_R = 5$ and $D_T = 8e-14$.

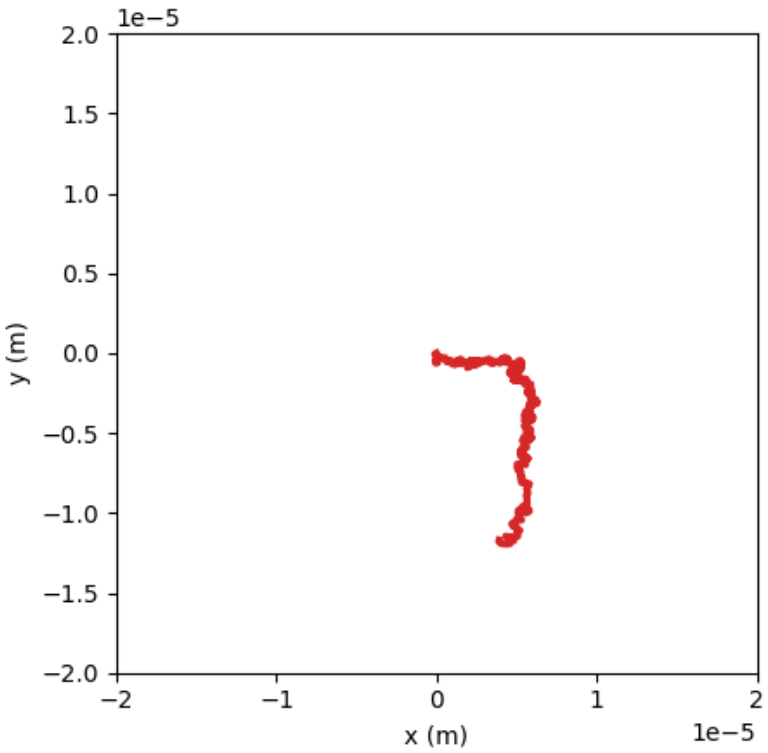

Figure 4: $v = 3e - 6$, $D_R = 5$ and $D_T = 8e - 14$.

9.1: c (D_T change)

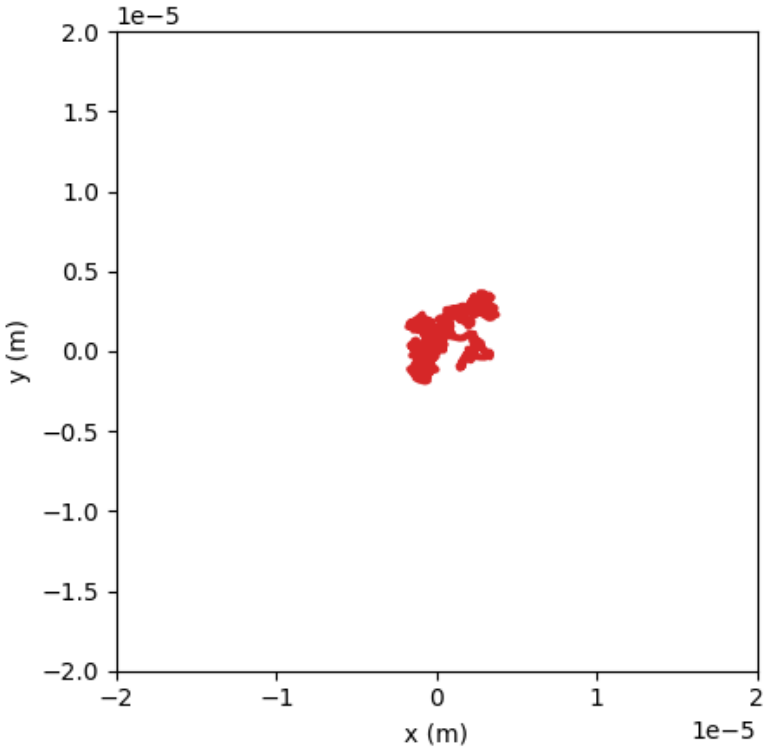

Figure 5: $v = 3e - 6$, $D_R = 0.5$ and $D_T = 2e - 12$.

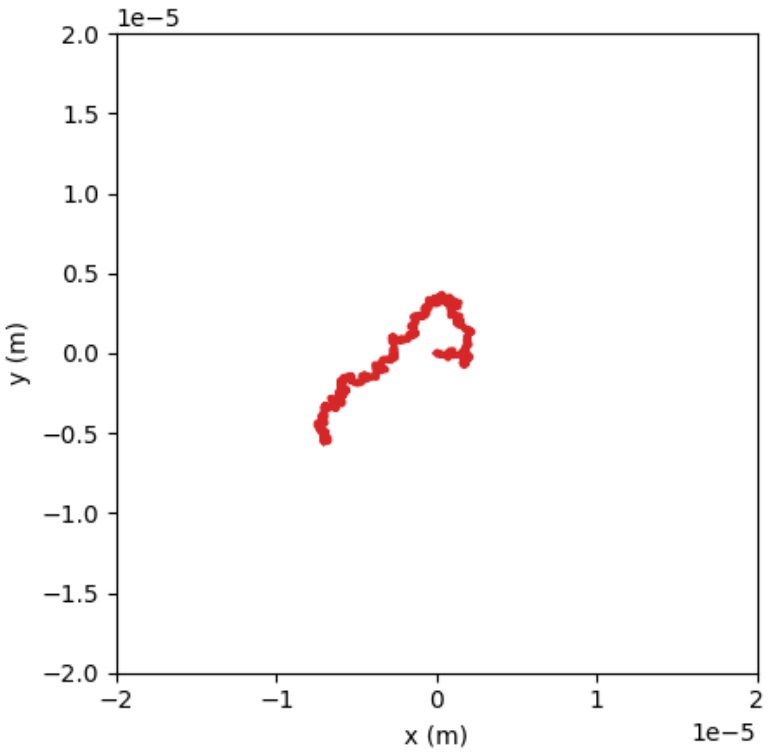

Figure 6: $v = 3e - 6$, $D_R = 0.5$ and $D_T = 5e - 13$.

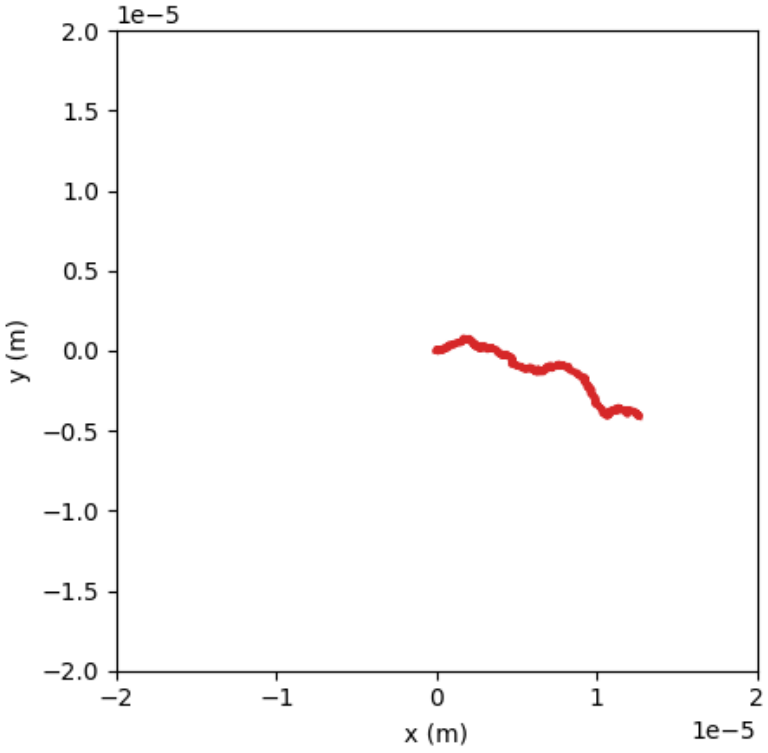

Figure 7: $v = 3e - 6$, $D_R = 0.5$ and $D_T = 8e - 14$.

9.1: d (D_R change)

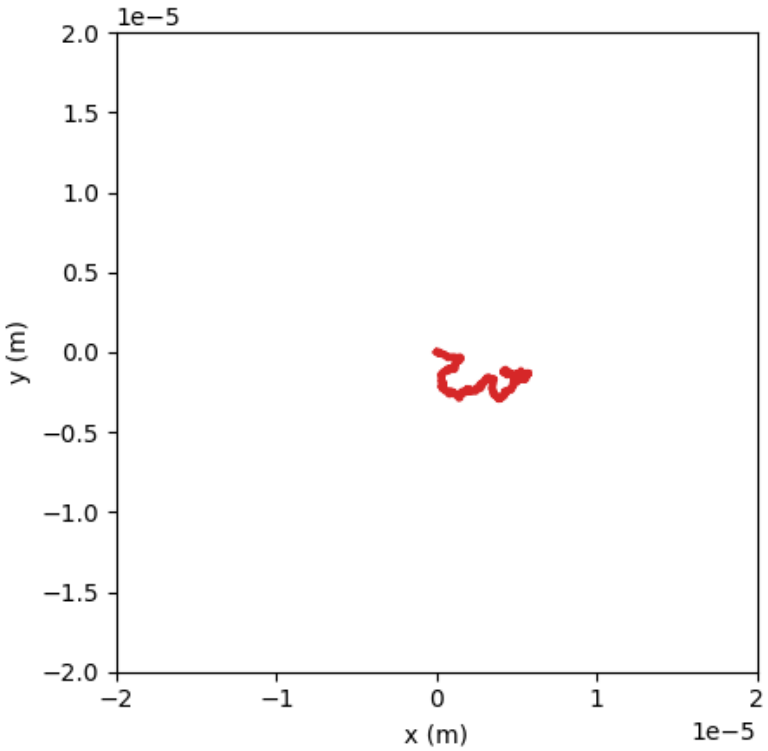

Figure 8: $v = 3e - 6$, $D_R = 5$ and $D_T = 8e - 14$.

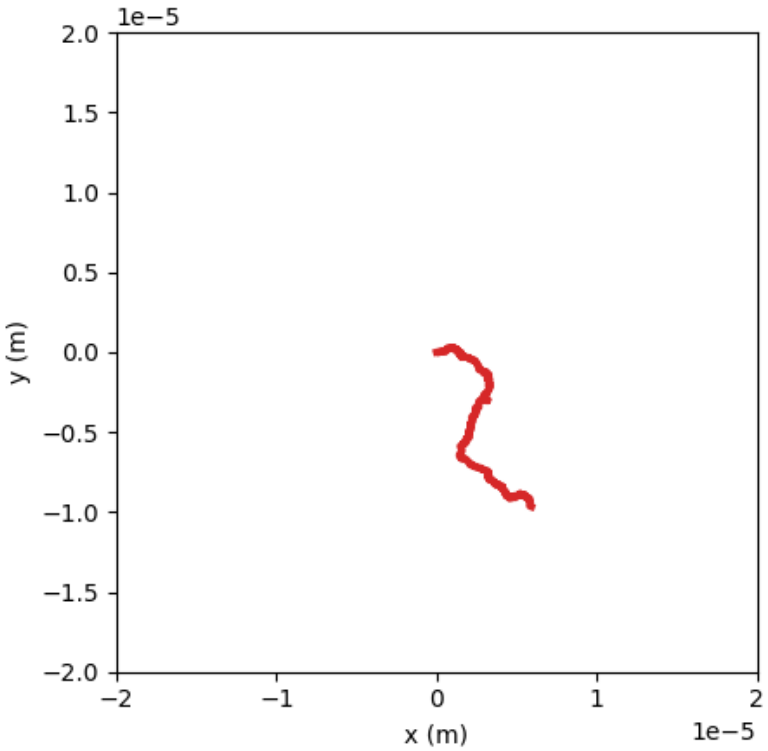

Figure 9: $v = 3e - 6$, $D_R = 0.5$ and $D_T = 8e - 14$.

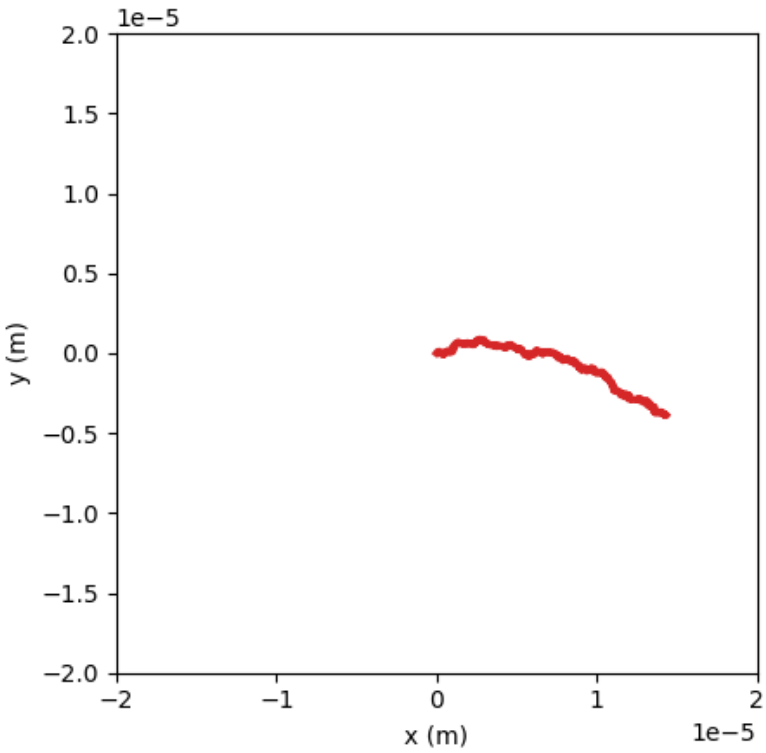

Figure 10: $v = 3e - 6$, $D_R = 0.05$ and $D_T = 8e - 14$.

9.2: a, b, c

10000 iterations for all runs in 9.2.

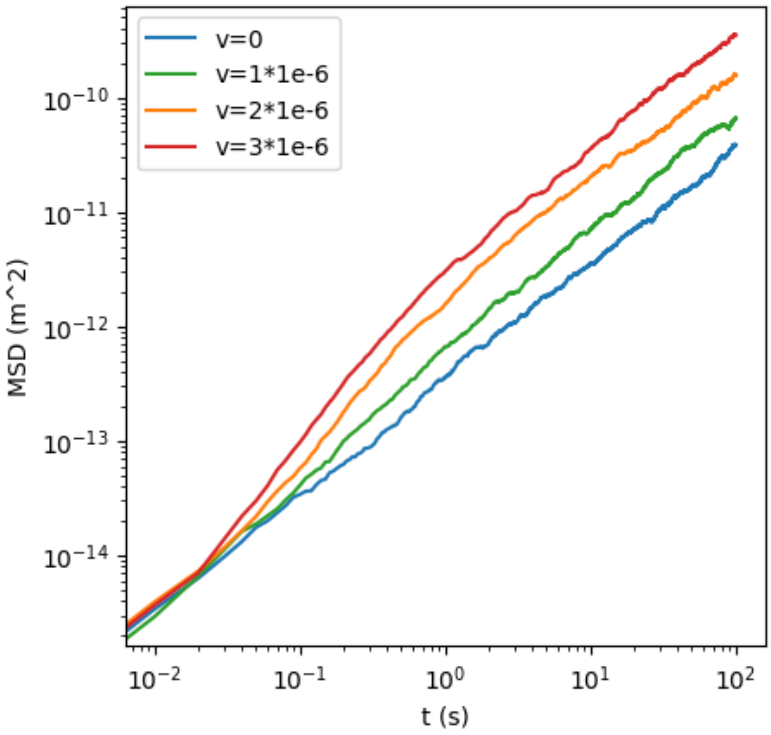

Figure 11: Ensemble averaged MSD. $D_R = 5$ and $D_T = 8e - 14$.

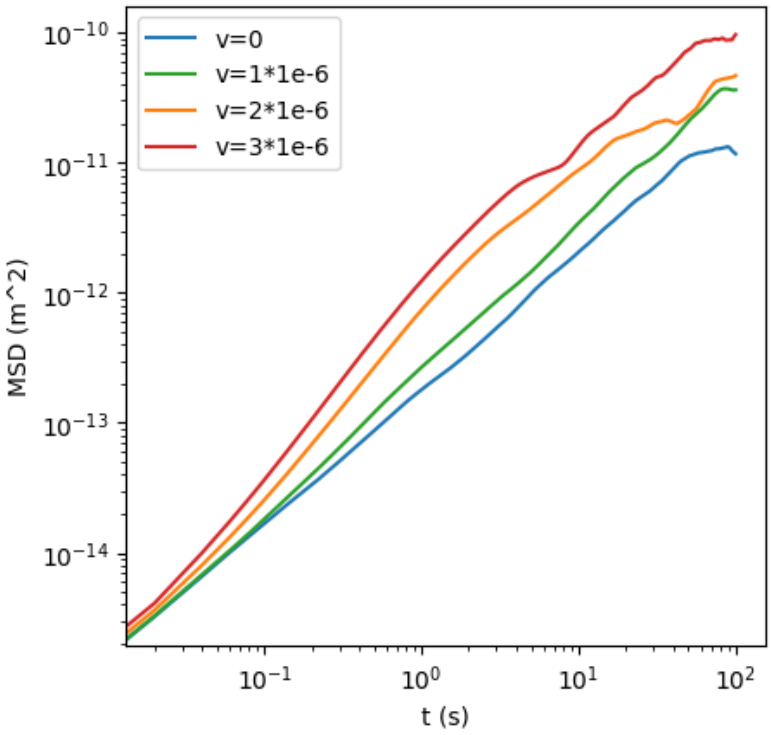

Figure 12: Time averaged MSD. $D_R = 5$ and $D_T = 8e - 14$.

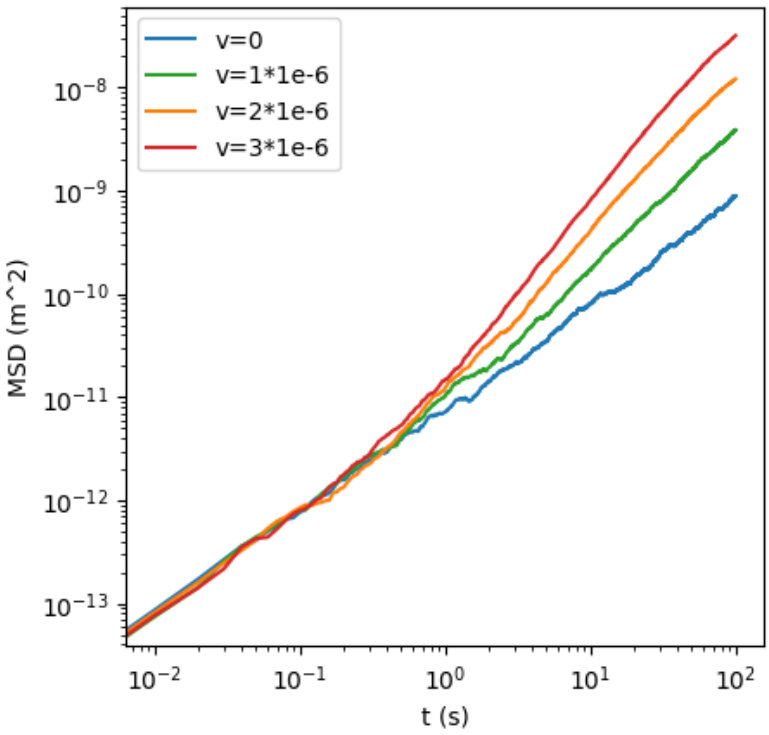

Figure 13: Ensemble averaged MSD. $D_R = 0.05$ and $D_T = 2e - 12$.

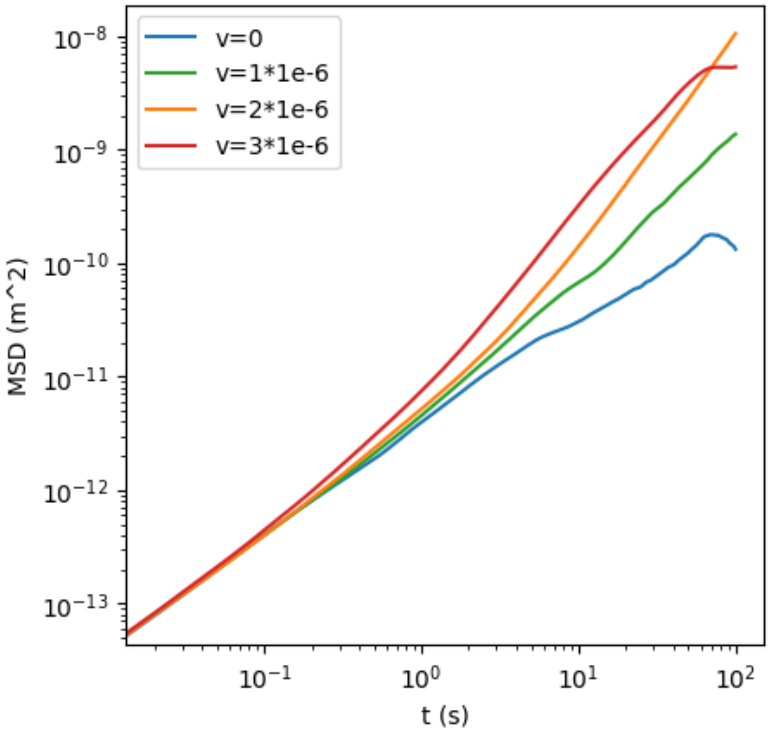

Figure 14: Time averaged MSD. $D_R = 0.05$ and $D_T = 2e - 12$.

9.3: a, b, c, d

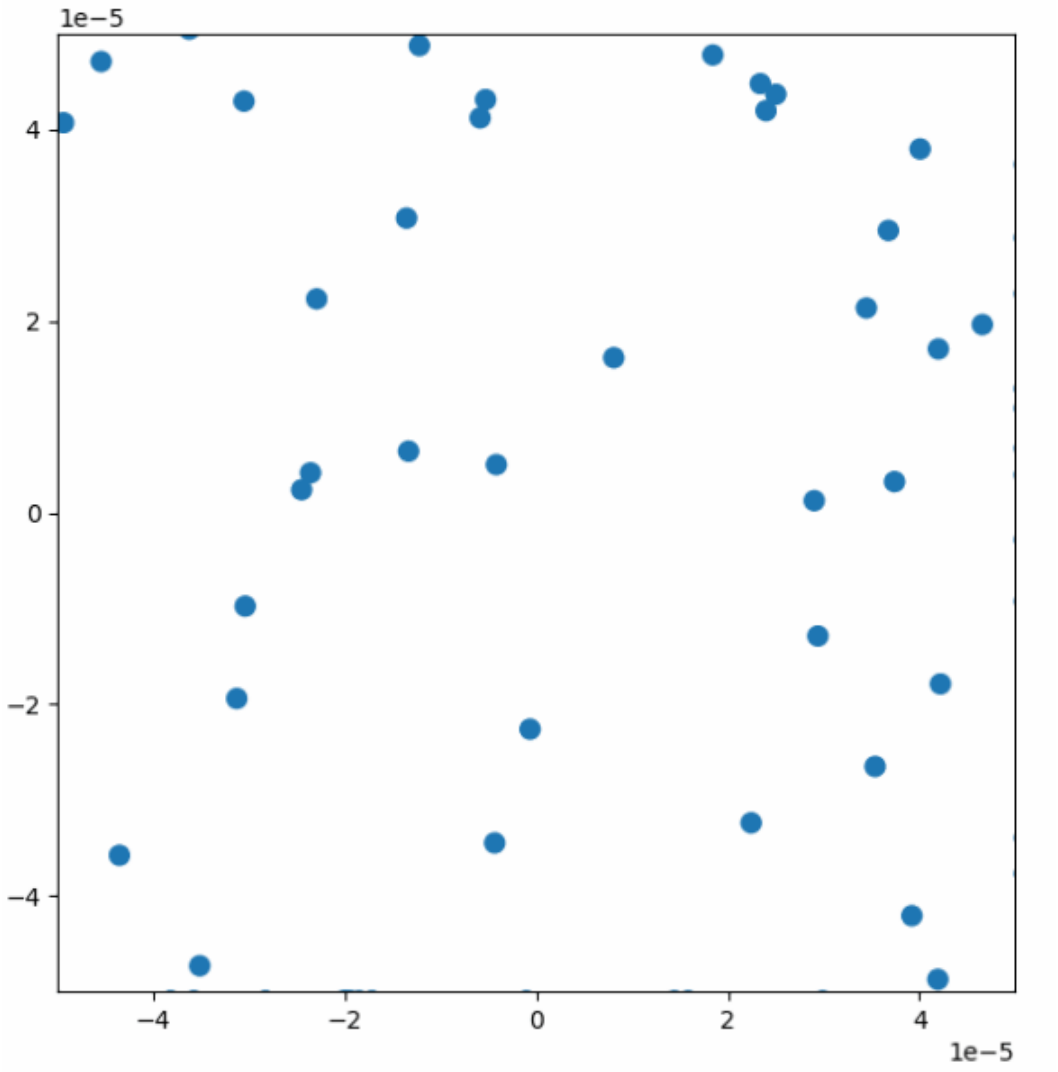

Figure 15: Both x and y-axis are length (m). No. time steps = 1000, no. particles = 100, $\Delta t = 0.01$, $v = 3e-6$, $R = 1e-6$, $D_R = 1$, $D_T = 0.1e-6$.

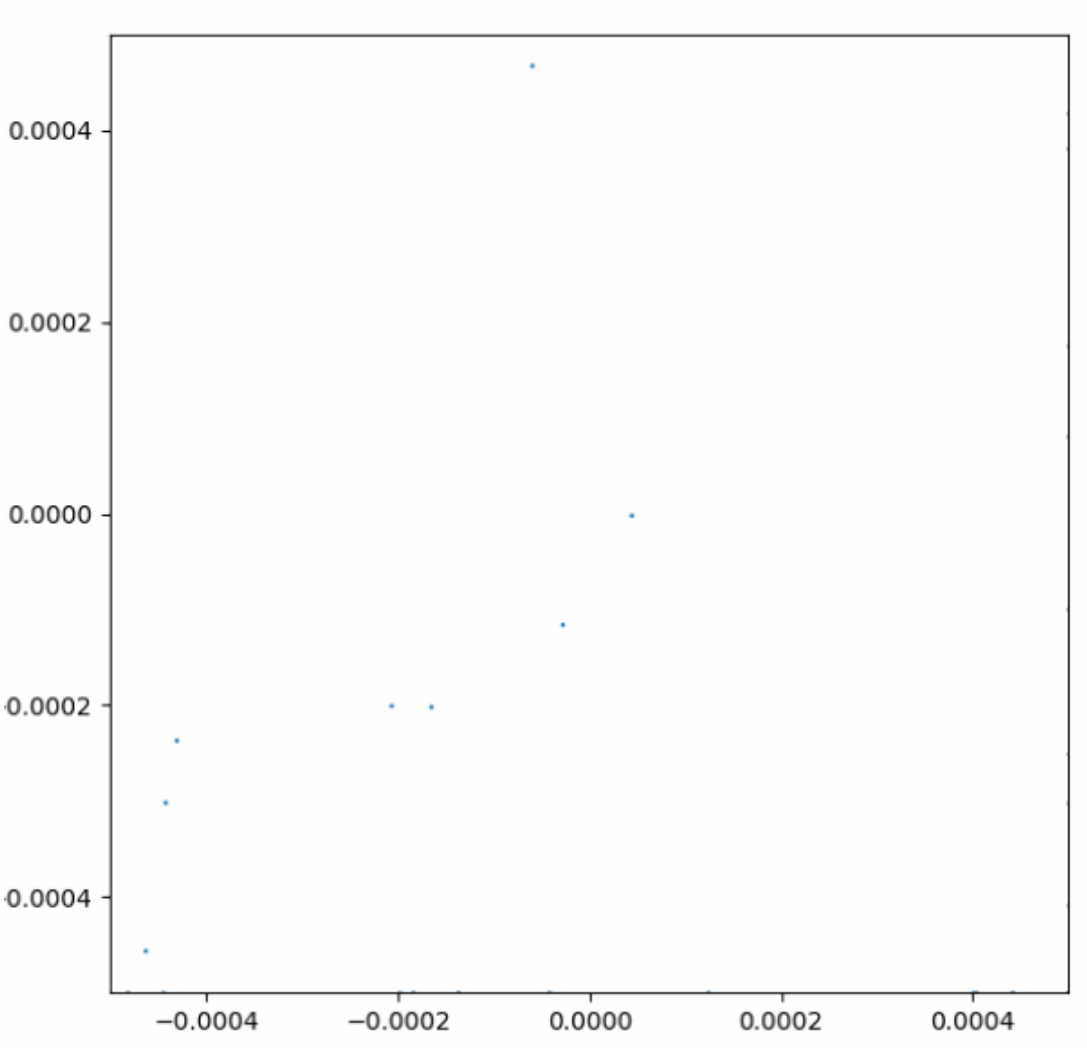

Figure 16: Both x and y-axis are length (m). No. time steps = 100, no. particles = 100, $\Delta t = 10$, $v = 3e-6$, $R = 1e-6$, $D_R = 1$, $D_T = 0.1e-6$.

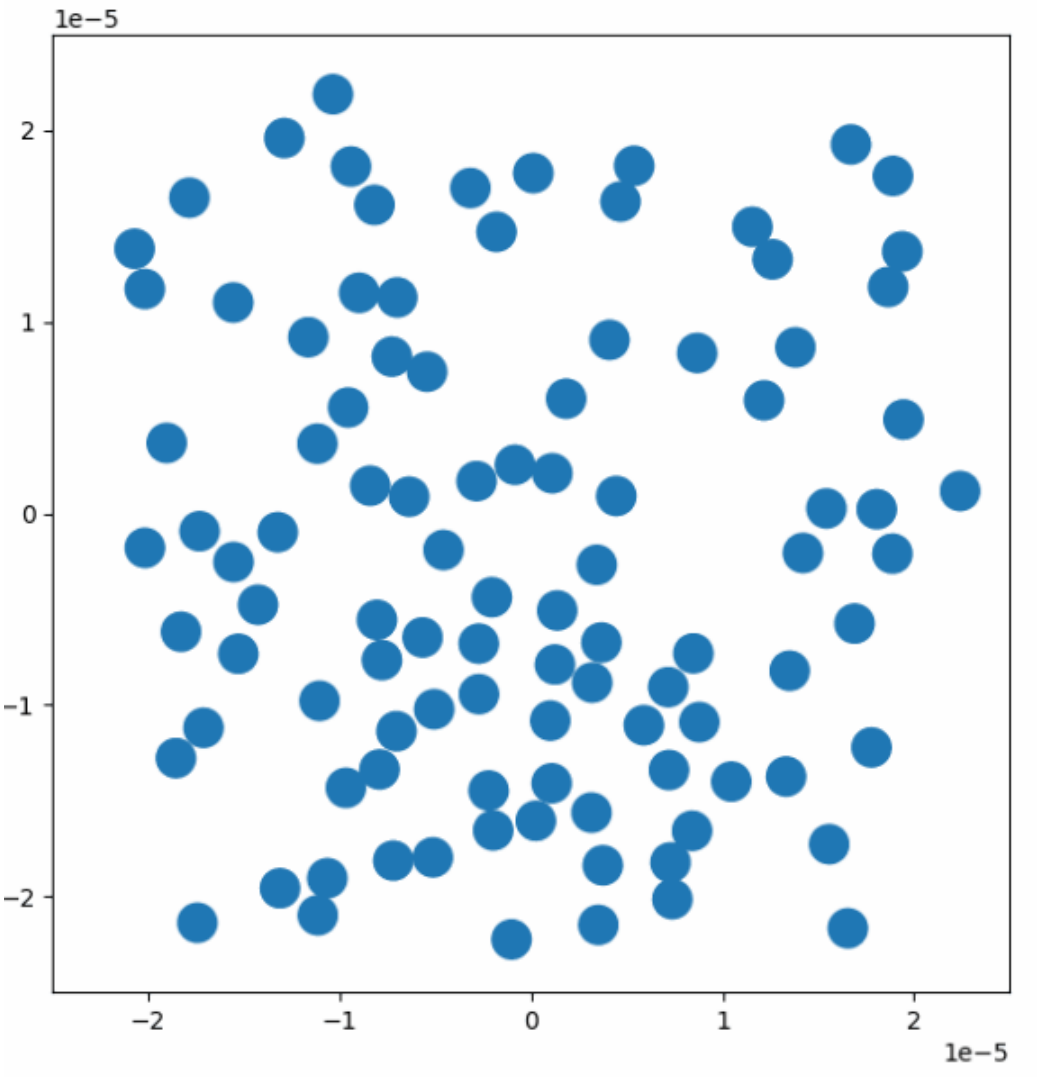

Figure 17: Both x and y-axis are length (m). No. time steps = 1000, no. particles = 100, $\Delta t = 0.000001$, $v = 3e-6$, $R = 1e-6$, $D_R = 1$, $D_T = 0.1e-6$.

For large Δt the particles "jumps" unrealistically and vice versa. Thus, the concentration of the particles is determined by Δt so the choice of Δt is very important for a physical correct behaviour of the simulation.

9.4: a, b

Unfortunately no clustering.

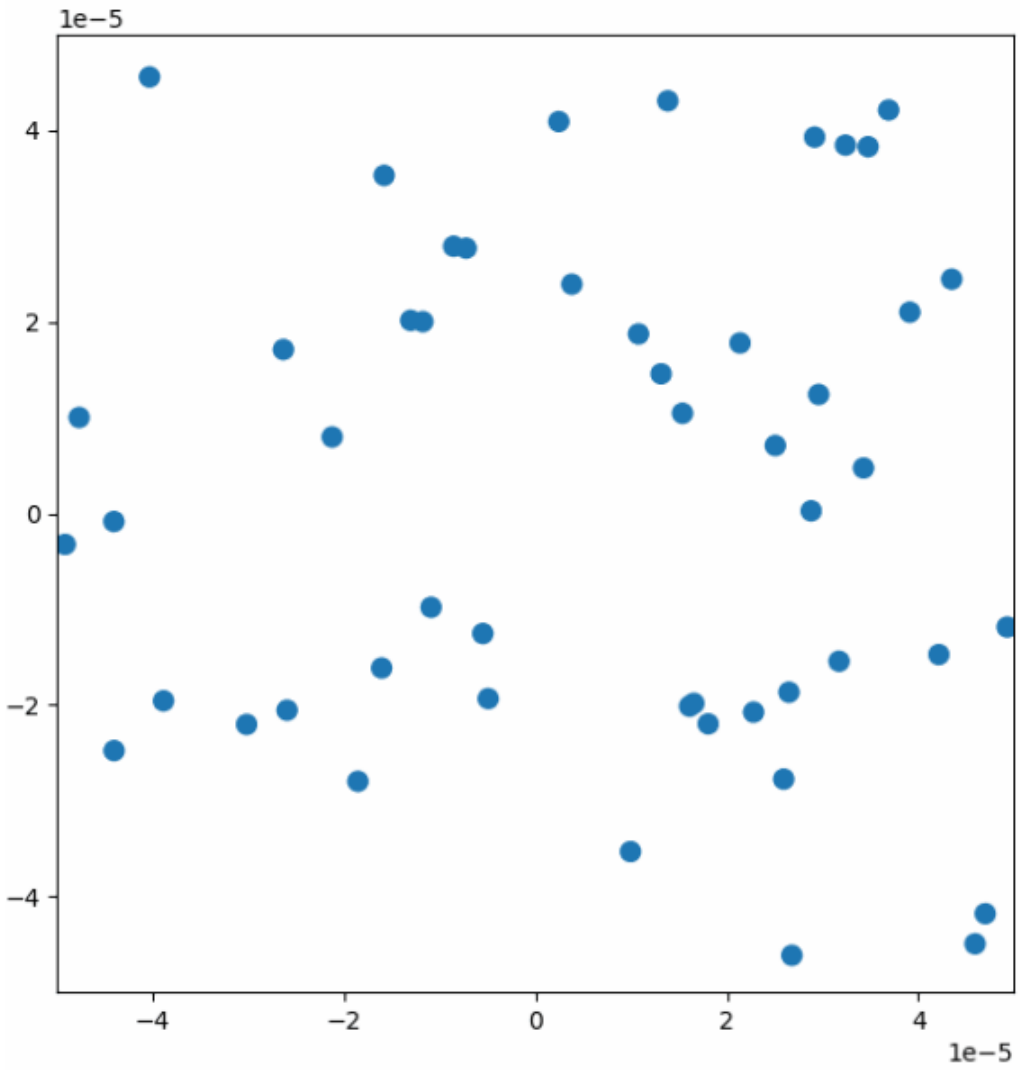

Figure 18: Both x and y-axis are length (m). No. time steps = 500, no. particles = 50, $\Delta t = 0.3$, $v_0 = 20e - 6$, $R = 1e - 6$.

9.5: a, b

Unfortunately no clustering.

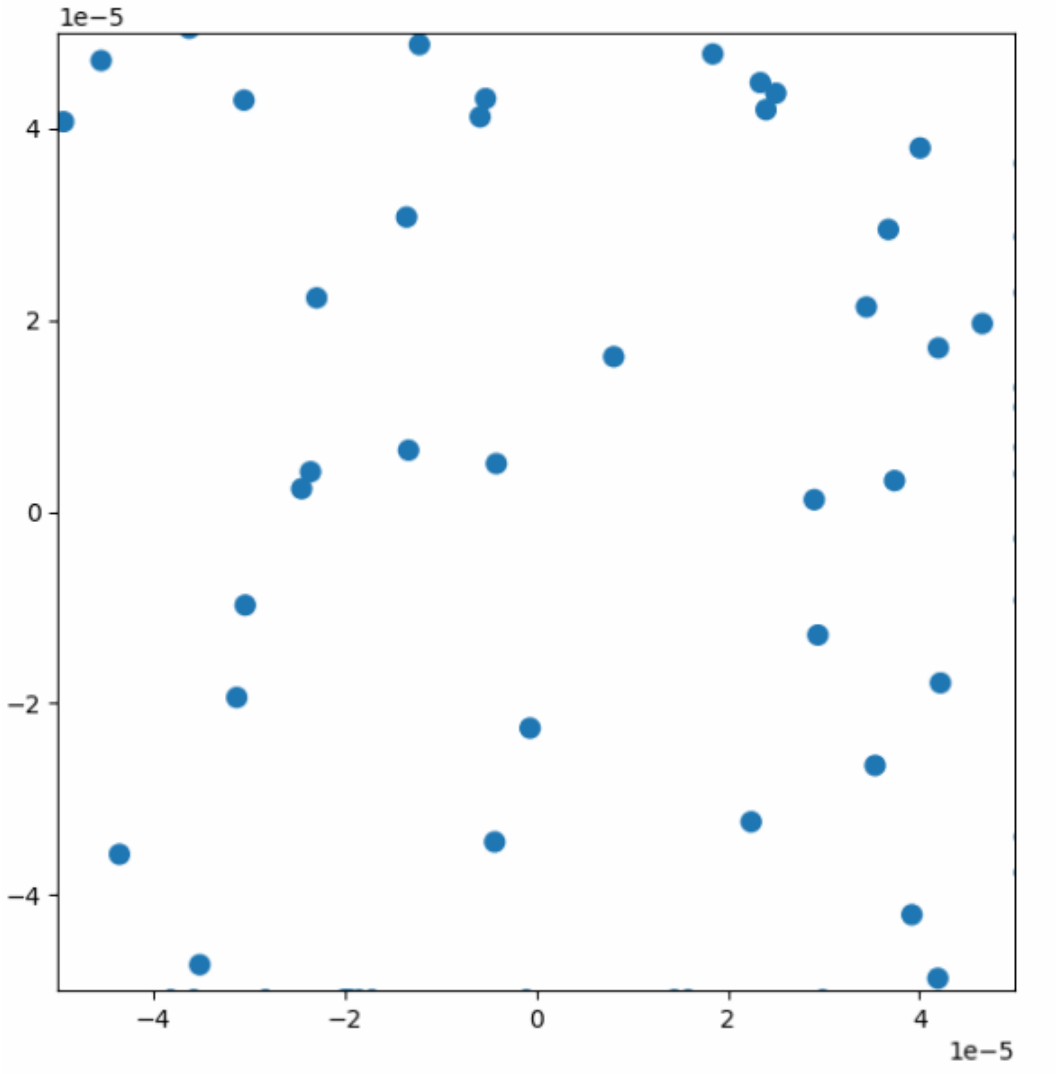

Figure 19: Both x and y-axis are length (m). No. time steps = 500, no. particles = 50, $\Delta t = 0.3$, $v_0 = 0$, $R = 1e - 6$.

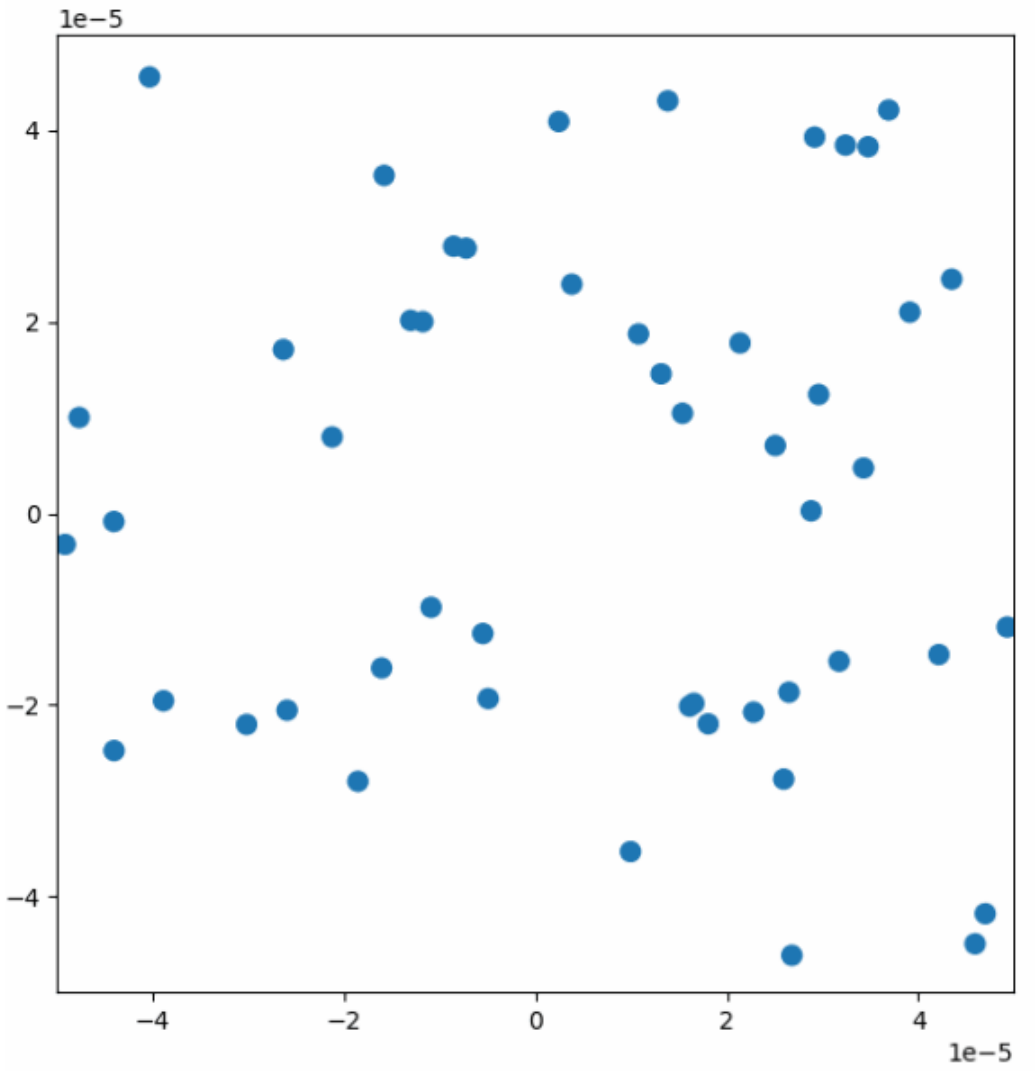

Figure 20: Both x and y-axis are length (m). No. time steps = 500, no. particles = 50, $\Delta t = 0.3$, $v_0 = 20e - 6$, $R = 1e - 6$.

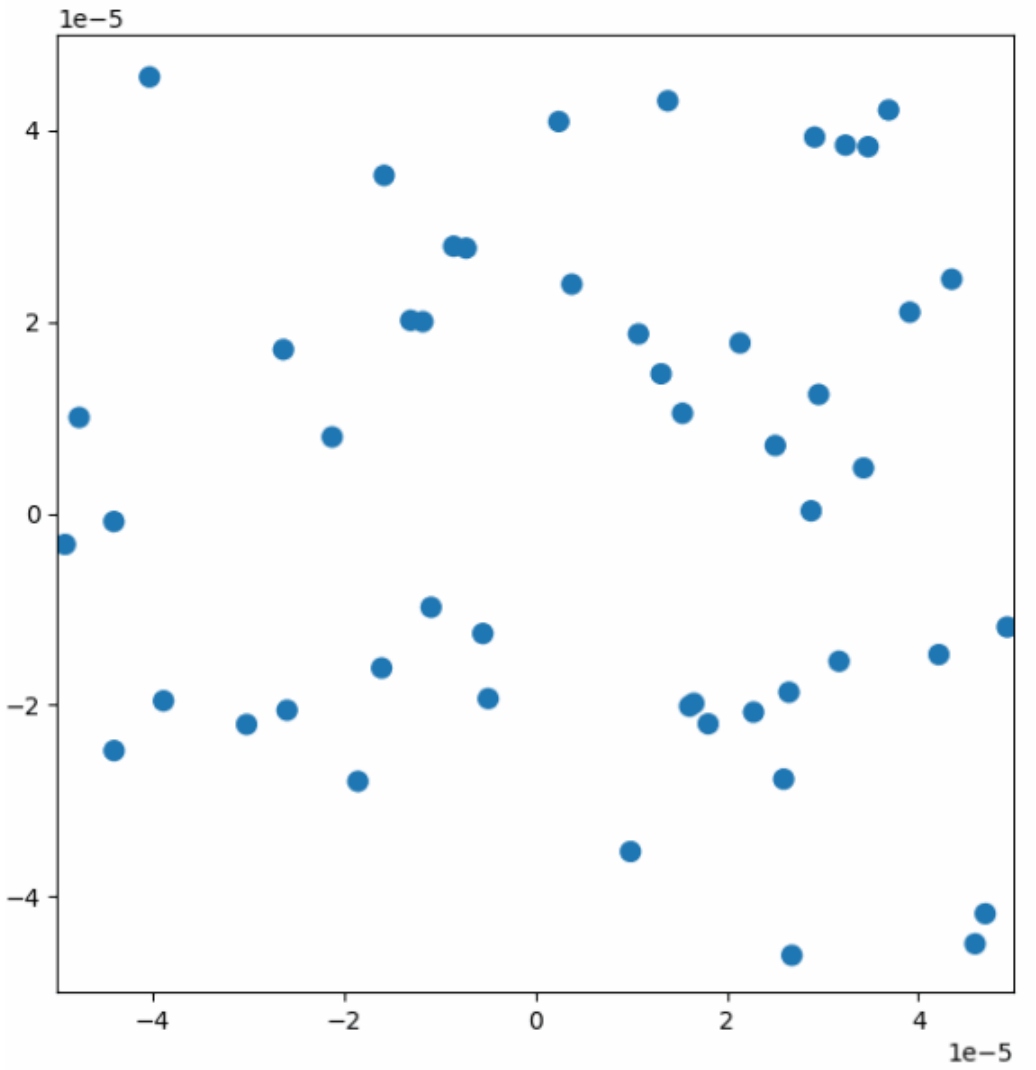

Figure 21: Both x and y-axis are length (m). No. time steps = 500, no. particles = 50, $\Delta t = 0.3$, $v_0 = 50 - 6$, $R = 1e - 6$.

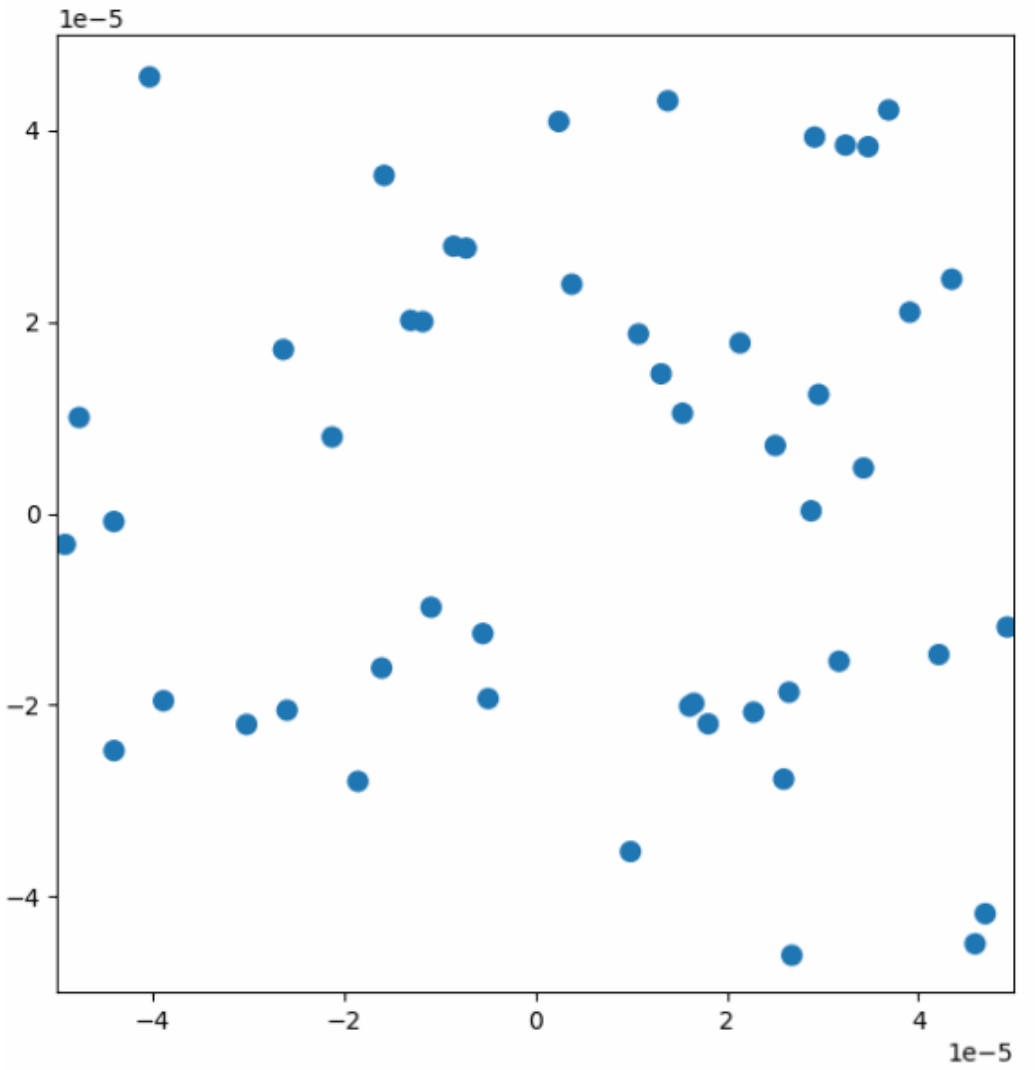

Figure 22: Both x and y-axis are length (m). No. time steps = 500, no. particles = 100, $\Delta t = 0.3$, $v_0 = 50 - 6$, $R = 1e - 6$.