

Ph22- Assignment 4

Daniel Chica

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PROBLEM 1

To begin, I wrote a function FF that returns the resulting force from an interaction between two particles of the same mass. I used this in another function that takes a list of initial radial positions based on angle and magnitude, and computes the force every particle experiences due to every other particle in the list. I added the force contributions in every direction and output that. Lastly, I decided to use an Euler integrator to gauge the position over time for this particle system based on the force equation. The Euler integration method might not be very accurate compared to the RK4 method, but it gave nice results and was less computationally expensive.

PROBLEM 2

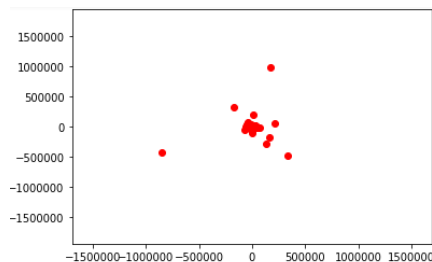


Figure 1: Large Scale Behavior

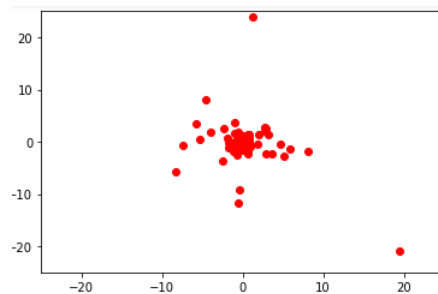


Figure 2: Local Behavior

For this part, I developed a list of a 100 random particle positions constrained to start in a unit circle. I ran this list through the integrator to track how the particles will move over time. In the python code I wrote a function that helps visualize this simulation over time through the use of a slider bar, so you can refer to that to see better results. Figure 1 shows the large scale behavior of the system which shows clusters of particles surrounding a larger central node, akin to a core and a halo. There are very few peripheral clusters, most of the mass is located towards the center. Figure 2 shows this same simulation, but I constrained the axes so we can zoom in and see more local behavior. Here we see a similar behavior to the large scale one, but the separation between particle is clearer. Since the simulation produces random

initial conditions every time, I ran it a few times and noticed that these behaviors seem to stay consistent, even if the raw ending position was different.
