Chanelle Friend CSC-390 Part 3

1. My chosen initial conditions for BODY C that…

(a) CAPTURED IN THE ORBIT:	**(b) ESCAPED THE SYSTEM:**	**(c) CREATED CHAOTIC DYNAMICS:**
initial position = -3.5e8m	initial position = -2.5e7m	initial position = -2.5e7m
initial velocity = $324.55\frac{m}{s}$	initial velocity = $1.93e3\frac{m}{s}$	initial velocity = $1.33e3\frac{m}{s}$

For my integration method, I chose the Velocity Verlet, which updates positions using half-step velocity and full-step acceleration, leading to better energy conservation.

2. see plots below

3. Was energy conserved?

For my simulations of Body C being captured in the Orbit (a) and Body C escaping the system (b), angular momentum was conserved for the most part, with a near constant representation.

However, when it came to total energy, only for (a) was it conserved. The total energy fluctuations from (b) can be explained by Body C leaving the system, and perhaps for the simulation of Body C creating chaotic dynamics (c), that may be explained by its chaotic nature; though it most likely may come from my numerical method.

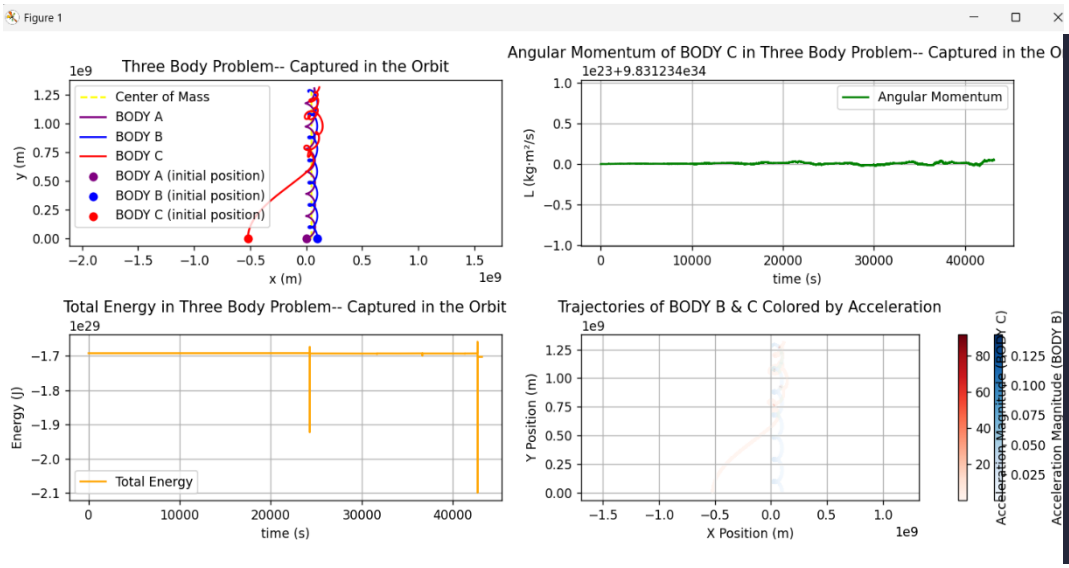
Did orbits appear stable?

The orbits do not seem stable for there is variety in all simulations' Body C's pathways.

Were outcomes sensitive to small changes?

These outcomes were very sensitive to small changes, especially when changing the velocity of (a) and (c). The outcome of (a) being captured and staying in orbit was affected by miniscule tweaks and changing the time step from 1 minute to 5 minutes and so forth drastically changed my results.

4. I only implemented the Velocity Verlet so I cannot compare it to an RK4 simulation, however it is more stable and conserves more energy compared to a Euler's Method implementation.

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Three Body Problem-- Captured in the Orbit
C:\Users\cfrie\Desktop\CSC-490 Projects\lab2\.venv\newbodysim.py:
  return m * np.cross(r,v)
Collision detected between BODY A and BODY C at time 1456140.00s
Collision detected between BODY A and BODY C at time 1456200.00s
Collision detected between BODY A and BODY C at time 1456260.00s
Collision detected between BODY A and BODY C at time 1456320.00s
Collision detected between BODY A and BODY C at time 1456380.00s
Collision detected between BODY A and BODY C at time 1456440.00s
Collision detected between BODY A and BODY C at time 1456500.00s
Collision detected between BODY A and BODY C at time 1456560.00s
Collision detected between BODY A and BODY C at time 1456620.00s
Collision detected between BODY A and BODY C at time 1456680.00s
Collision detected between BODY A and BODY C at time 1456740.00s
Collision detected between BODY A and BODY C at time 1456800.00s
Collision detected between BODY A and BODY C at time 1456860.00s
Collision detected between BODY A and BODY C at time 1456920.00s
Collision detected between BODY A and BODY C at time 1456980.00s
Collision detected between BODY A and BODY C at time 1457040.00s
Collision detected between BODY A and BODY C at time 1457100.00s
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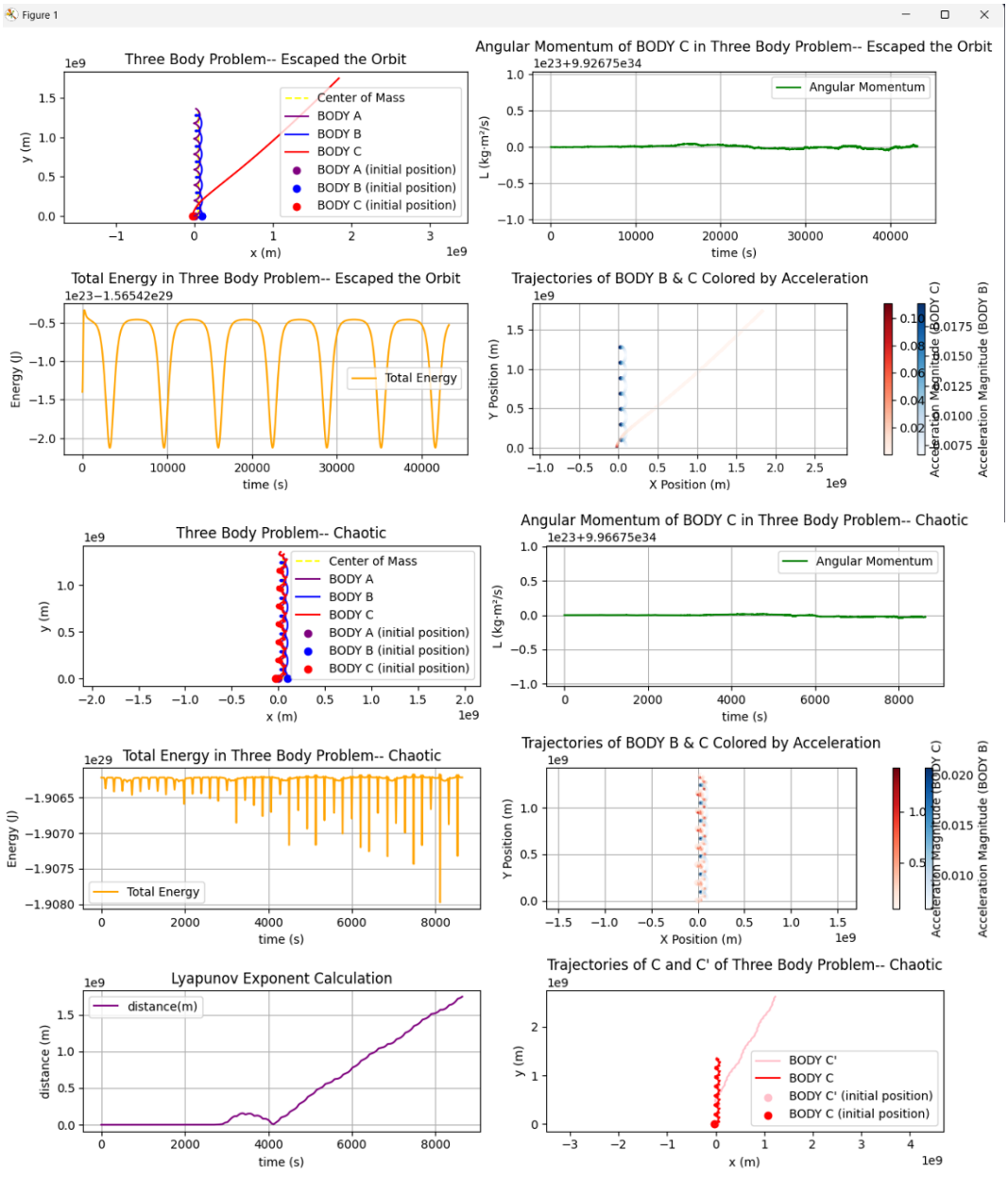

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Three Body Problem-- Chaotic
Collision detected between BODY A and BODY C at time 2431020.00s
Collision detected between BODY A and BODY C at time 2431080.00s
Collision detected between BODY A and BODY C at time 2431140.00s
Collision detected between BODY A and BODY C at time 2431200.00s
Collision detected between BODY A and BODY C at time 2431260.00s
Collision detected between BODY A and BODY C at time 2431320.00s
Collision detected between BODY A and BODY C at time 2431380.00s
```