Introduction to Computational Physics - Exercise 2

Simon Groß-Bölting, Lorenz Vogel, Sebastian Willenberg

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The code for this exercise sheet was written in a single program:

```
import numpy as np
import matplotlib.pyplot as plt


class Body:
    def __init__(self,mass,position,velocity):
        self.mass = mass              # mass of the body
        self.position = position      # inital position vector
        self.velocity = velocity      # inital velocity vector
```

1 Numerical Simulation of the 2-Body Problem

- The plot of the simulation looks like the following:
- The two bodies can rotate around each other in a circular fashion with a separation of 1 when the velocity is equal to $v_0 = 2\sqrt{\frac{GM_1}{R_0}}$.
- If we choose the velocity to be equal to $\frac{v_0}{\sqrt{2}}$, the numerical model will... .
- The eccentricity of the Runge-Lenz-Laplace Vector looks like the following:
- If we choose the initial velocity to be larger to $\sqrt{2}v_0$, the numerical model will... .
- If we choose the velocity to be equal to $\frac{v_0}{3}$ and experiement with decreasing the time step we noticed, that...

2 Error Analysis of Euler Scheme

(a) We have varied the initial velocity ...

(b) Implementing the Leapfrog scheme...