

The Chinese University of Hong Kong

PHYS3061, 2nd semester, 2019-2020

Homework 1

After you finish most of the lab3, you can modify the initial conditions and interaction force to simulate other systems. In this homework you will need to simulate the Sun-Earth-Moon system.

0. (no marks) Rewrite the Verlet algorithm so that the force/acceleration is calculate in a separate function. This will make your code easier to be modified for other system
1. Write the function for gravitation force interaction between two body of arbitrary mass.
2. Simulate the Sun-Earth-Moon system using gravitational force (assume they are point mass)
 - a. Use appropriate unit: length in AU or Earth-Moon distance, Masses in Sun/Earth/Moon mass, time in day(s). Label them in your source code.
 - b. Initialize the system, you can assume all the orbits circular and on the same plane.
3. Make an animation of the system for first 100 years, you don't need to output all the time steps.
4. Plot the trajectories of Moon around Sun, Moon around Earth and Earth around Sun for first 10 year.
5. Calculate and plot the average distance between moon and earth for every 500 years in a 100,000 years simulation. If you are using Python or other slow programming language, you can use a shorter simulation time. For example, 10,000 years or 5,000 years.

You need to submit: source code, plot and txt file(s) of trajectories , .xyz animation, plot and .txt file of average distance.

Please comment your code, including how to compile and run your code. Submit to hw1 in department server using your 3061-XX account.

Due date: 16th Mar 2020 Score will be deducted if the submission is late.