Ay190 – Worksheet 13
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Date: February 22, 2014

I worked with Daniel DeFellipis.

1 Problem 1

I downloaded and familiarized myself with the code and state vector, which holds 3-D positions and velocities of each object in the simulation.

2 Problem 2

I completed the code and tested it successfully on the Sun-Earth system. For the integration, I used the RK2 method. Figure 1 shows the orbital path of the Earth over 5 years (10000 iterations). The Earth's orbital radius, while oscillating slightly throughout the orbit, stays approximately constant (Figure 2).

3 Problem 3

I test energy conservation by summing the kinetic and potential energies of all particles. The result for the Sun-Earth system is shown in Figure 3. The energy oscillates with the Earth's orbit, but stays approximately constant.

4 Problem 4

I used my code to integrate the orbits of the stars around Sgr A^*. The orbits of the stars at the end of 100 years are shown in Figure 4. The total energy of the system is periodic, but oscillates more than the Sun-Earth system did. There also appears to be an overall downward trend in relative energy 5.

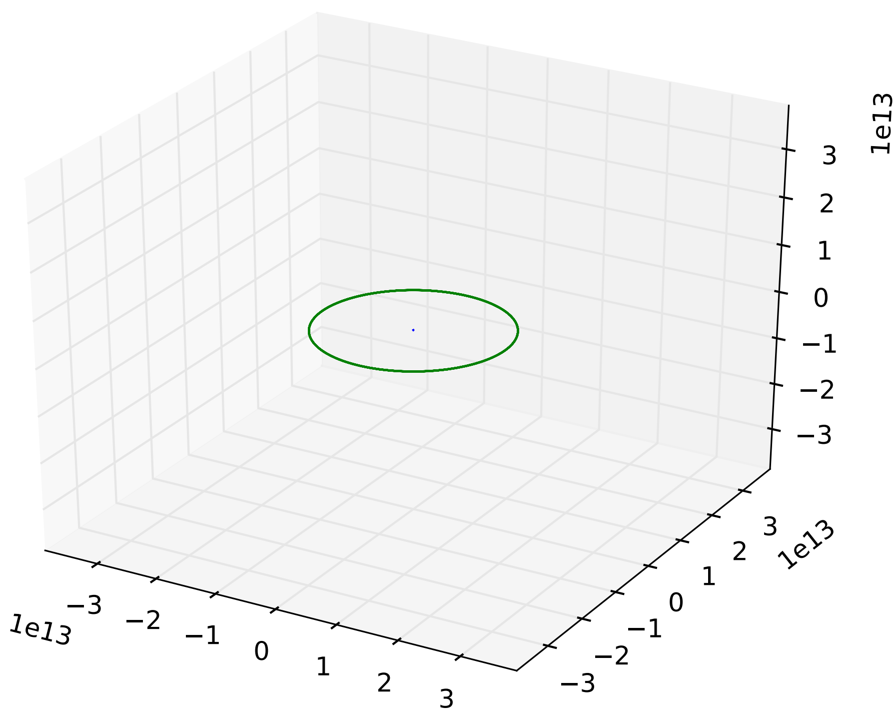

Figure 1: Five-year orbit of the Earth.

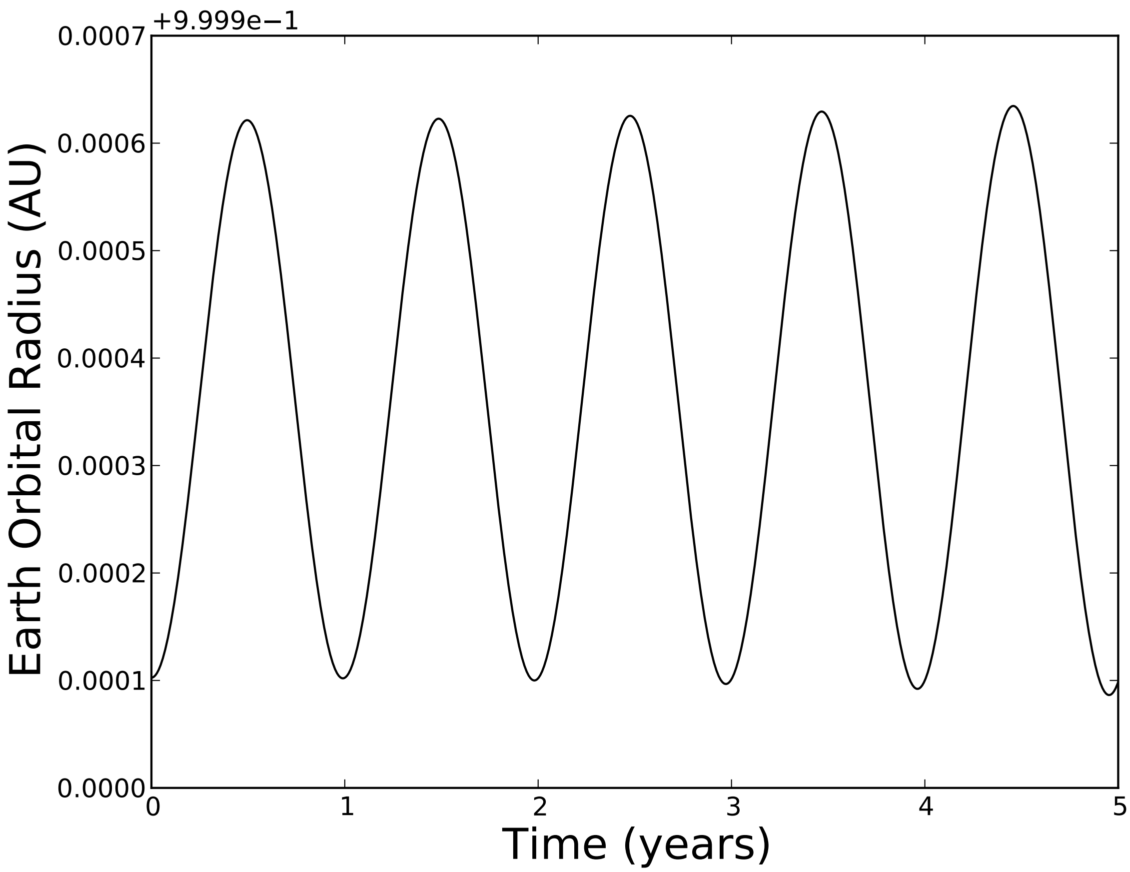

Figure 2: Orbital radius of Earth over five years. The radius oscillates throughout each orbit.

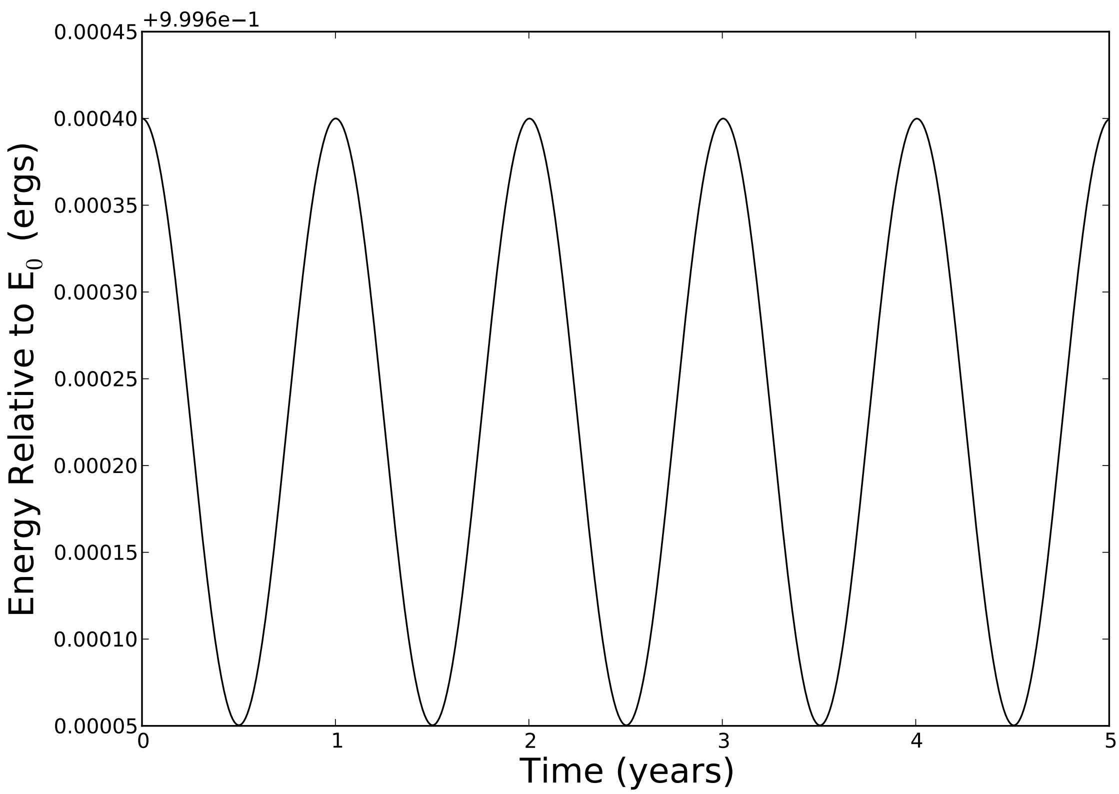

Figure 3: Relative energy conservtion for the Sun-Earth system. The energy oscillates throughout each orbit.

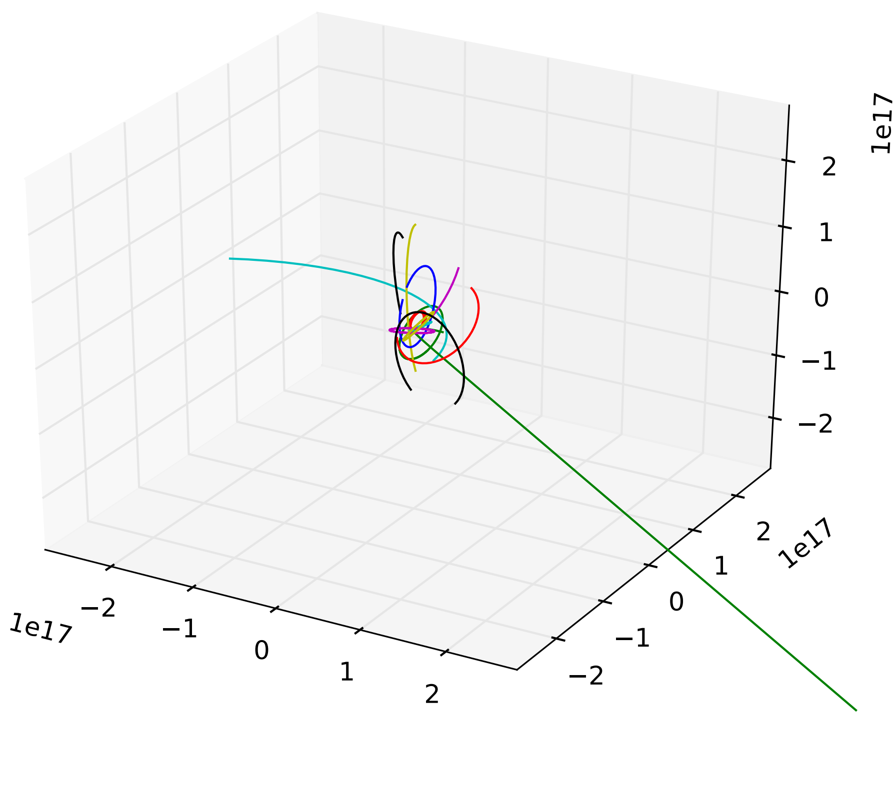

Figure 4: Orbits of the stars around Sgr A* after 100 years.

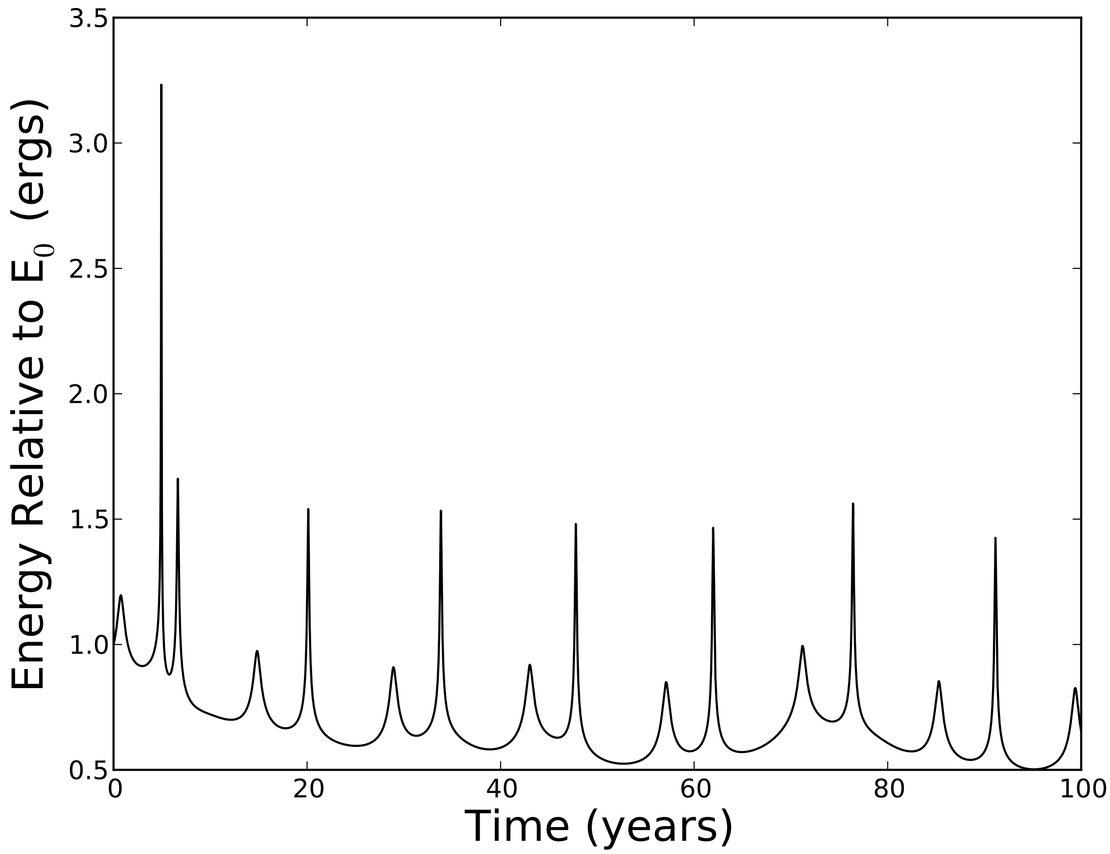

Figure 5: Total energy of the stars around Sgr A*. Like for the Sun-Earth system, the energy oscillates, but in a more complicated pattern. There is also an overall loss of energy.