

Assignment 1: Orbits of binary systems.

Submit on or before 18th Sep 2020

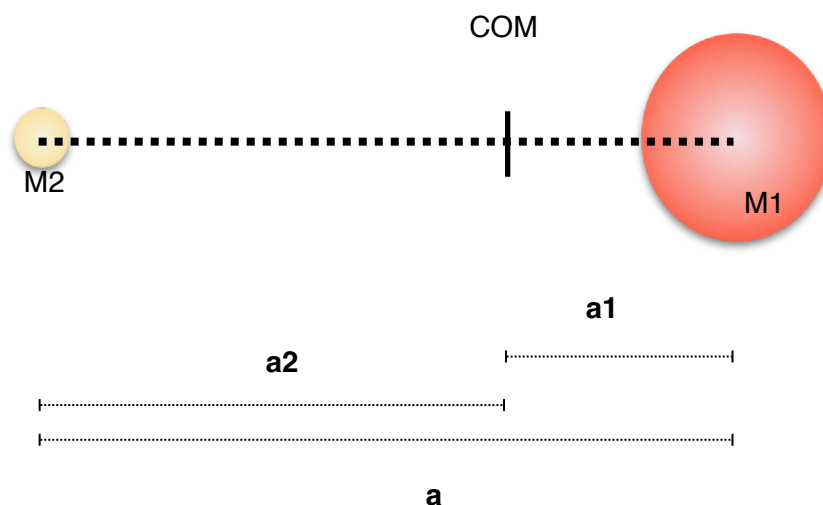
This assignment is to make animations as we see in the two associated gif files (source:wikipedia). Let us assume the simplest form of orbits (circular).

Let us consider a binary system (it could be two stars, a star and a planet, or a planet and its satellite), with component masses M_1 and M_2 , and orbital separation a , orbiting around the common center of mass (COM) in circular orbits. It can be easily shown that in a coordinate system with origin at the center of mass of the system,

$$M_1 a_1 = M_2 a_2 \quad \text{---(1),}$$

$$a = a_1 + a_2 \quad \text{---(2),}$$

where a_1 and a_2 are the distances of the component masses from the center of mass. See the figure.



The animation should show both components doing circular motion around the center of mass with respective orbits (as you can see in the gif files from wikipedia).

Produce animations for (i) $M_1=M_2$ (ii) $M_1 = 10 M_2$ and (iii) $M_1 = 10^6 M$

The value of a *is your choice*. As a first step you can get the orbits, and then go ahead to make the animation. As seen in the gif files, mark the position of the COM; and have the sizes of the binary components proportional to their masses.