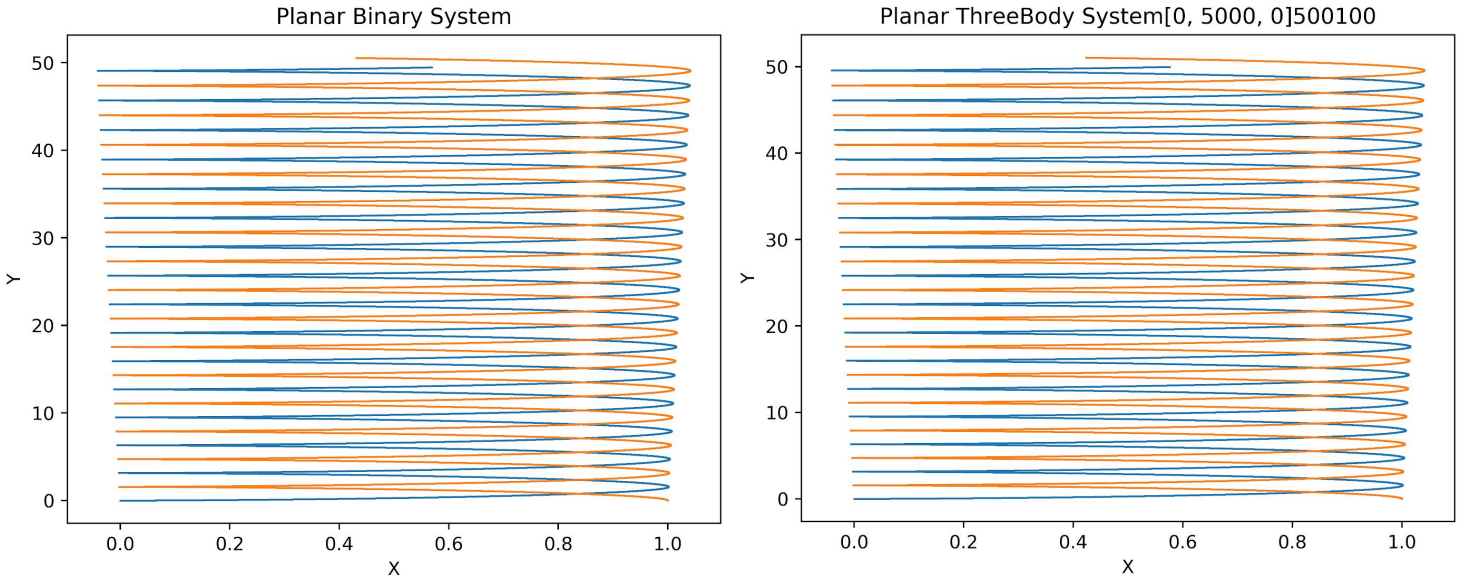
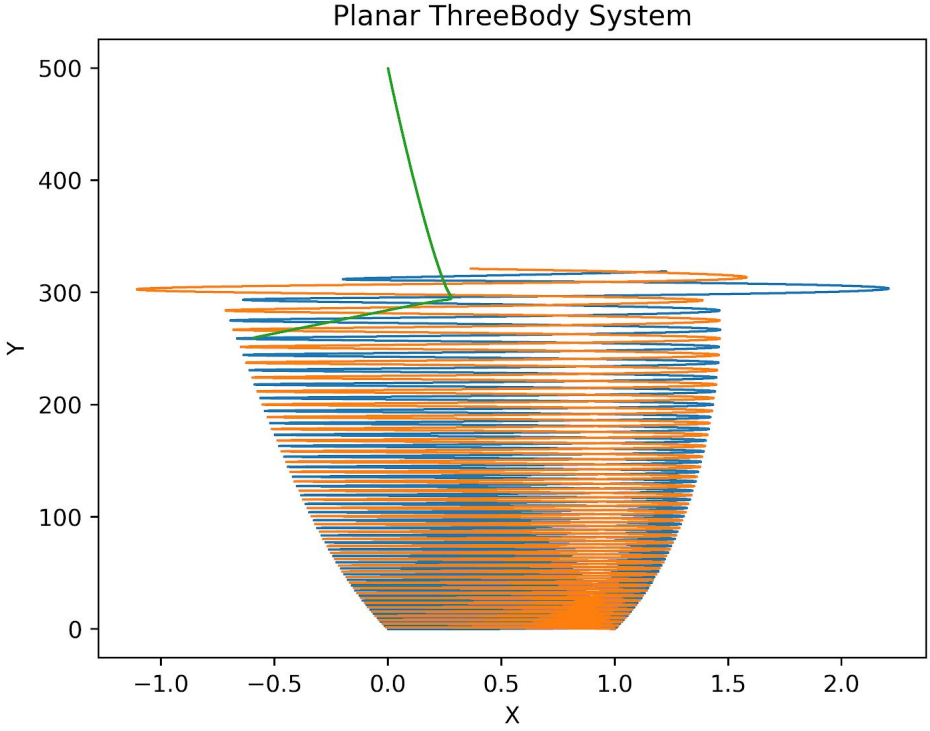
CSCI 4446 Spring 2019 PS13
Derek Wright
Note: worked with Keegan McNamara

1.

The binary system, with the third body sufficiently far away, should indeed orbit as normal. Below are two images from just the binary system versus the three-body system with the third body very far away (5000 units):



As you can see, the results are almost identical. One note, however, is that the center of mass of the binary system has a x-coordinate of 0.5, **not** 0.0. For all future runs of the three-body system, 0.5 will be used as the I.C. in the x-axis because looking at the image from Hut-Bahcall, the third body seems to be collinear to the COM of the binary. As an example, I don't want the binary system to arch one direction, as was seen in the following scenario:



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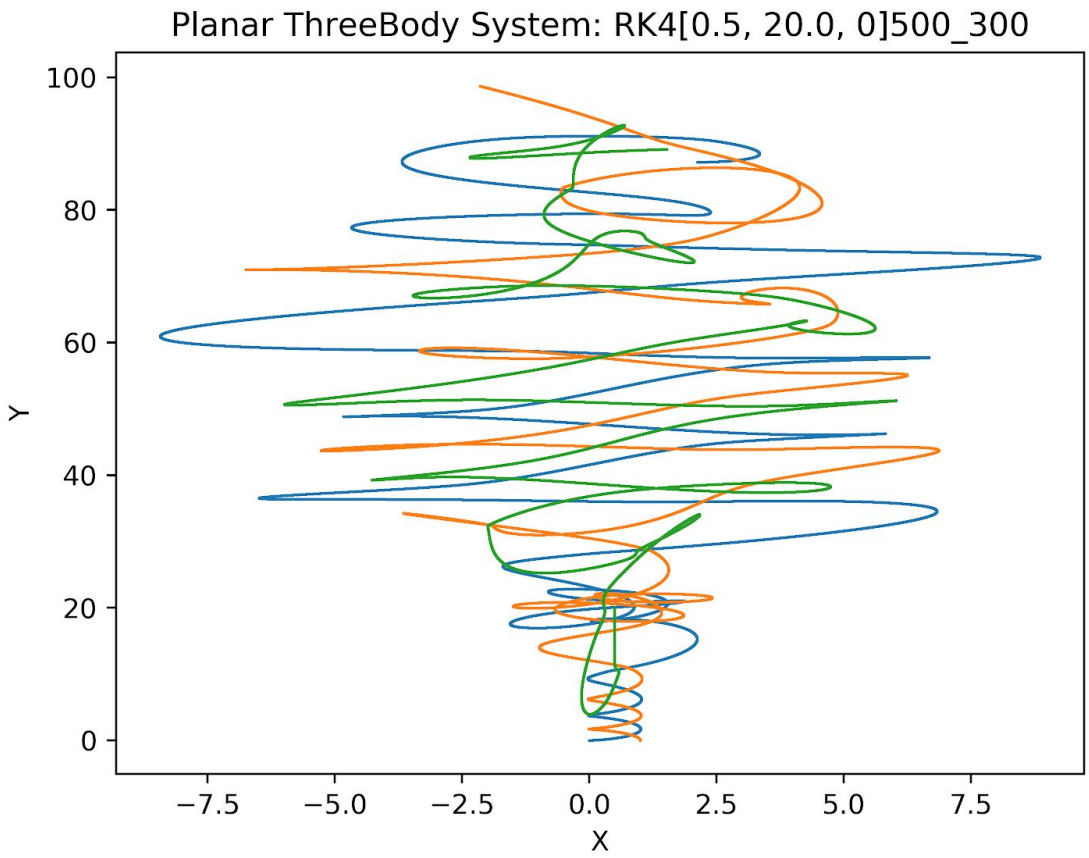
2.

Running using the initial conditions as indicated:



This is not the same as the Hut-Bahcall image, but I suppose getting a picture similar to theirs was nothing but hopeful thinking. Playing around, I never saw the behavior where the system would eject one of the bodies and the remaining two would follow a stable orbit once more.

There are many reasons our pictures might not be the same, since there are so many knobs to turn. I don't know what solver they were using, if it was adaptive or not, what their timestep or tolerance was, duration of run, etc.

What I do see is complex interaction of the three bodies, which is what I wanted (and fun to watch).

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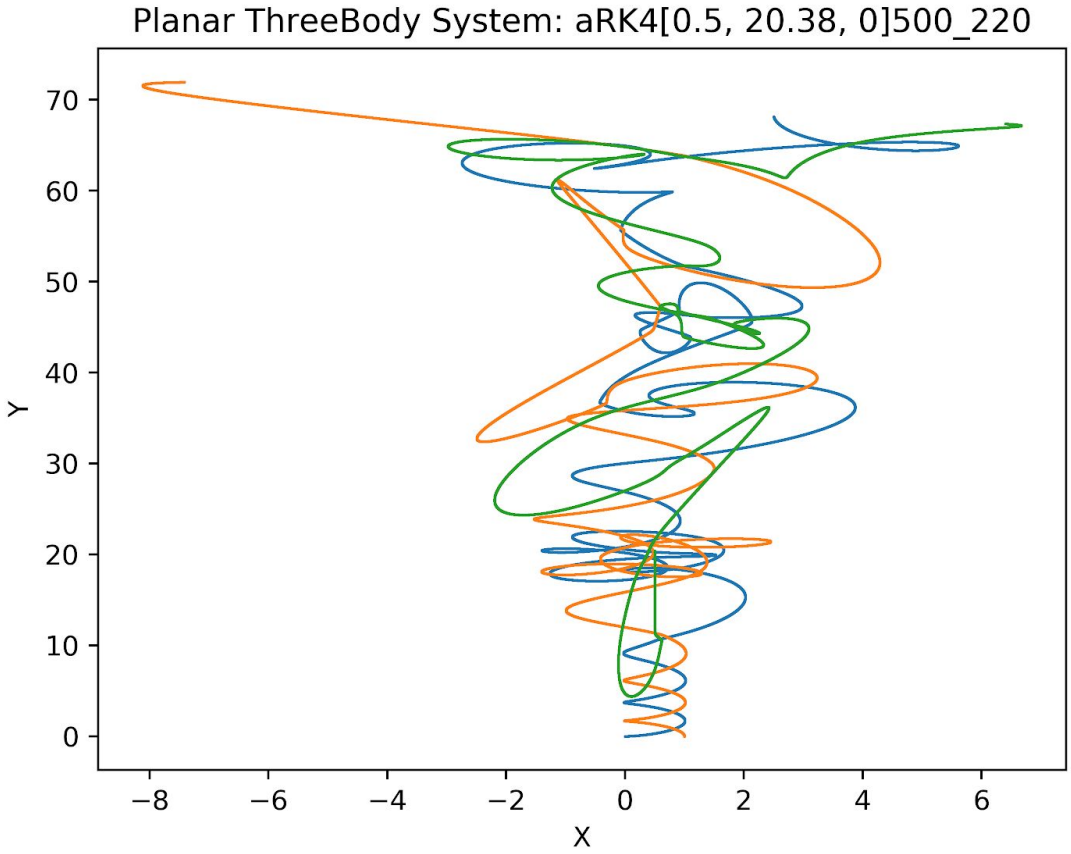
3.



This is the closest to ejection and the Hut-Bahcall image I could get: The second and third star orbiting each other while the first star is opposite the other two.

Some other runs are below, but what I saw was unilaterally complex, and very sensitive to initial conditions. A slight change in true anomaly (which is mimicked by starting the third star at a different distance) can have a large effect on the trajectories.

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