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Physics 230

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Dr. Transtrum

Final Project Proposal

For our final project we propose to model a system of black holes and show a star passing through this system. We will assume the entire system is planar, making it a bit easier to graphically represent the results. We may simulate more than two black holes and include an additional parameter to add more if this seems plausible. We will have two graphical representations of this system, one being a “bird’s eye view” of the system, showing how the star and black holes interact, with displays at the bottom of the graph showing the velocity of each object. The second graph will be a 3-Dimensional plot of the gravity wells of each of the objects.

We will divide the project into two main sections. The first of which is calculating the forces on each of the objects and then using that to calculate their positions and velocities at any given time. This will take five parameters, the initial x and y coordinates, the x and y components of the velocity of the object and the time you want the simulation to propagate for. Jarrod will be in charge of this as he has some experience with orbital dynamics because he is an astrophysics major. The second part of the project will be to animate the different displays to show the positions of each of the objects as well as a gravitational potential plot. RJ has a great understanding of multidimensional spaces from his math minor so he will create the plots.

This project will require an understanding of graphical analysis to show where the objects are at any given time. It will also require us to analyze the system relativistically as the velocity of the star cannot go above 3\*10^8 m/s. It will also require us to analyze a three body problem and have the computer constantly updating the velocities for each of the bodies.

The computers we use may not be able to handle the force calculations for more then just a few bodies. This would lead to us being unable to include more black holes. The resolution of the graphical representation of the gravitational potential may also be a challenge. This would occur because of the discrepancy between the mass of the star and the mass of the black holes. Because the black holes are much more massive they would have a much deeper gravitational potential.