Proposal for project: 3-body system

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What we will simulate?

In this project, we are planning to simulate a 3-body system: This is a combination of a binary stars system and a planetary star system, in which the binary star system can be seen as a planet in the planetary star system as a whole. This is a 3-body system similar to the one that contains Sun, Earth and Moon but with some differences. The rotating two stars in the binary star system are rotating around a point on the line connecting them instead of one around the other, while the binary stars system rotate around the star in the planetary system at the same time. As a result, the trajectory of two binary stars should no longer be relatively regular ovals or circles, but irregular shapes that may even not be closed. Only the center of the binary stars should have a trajectory with a relatively regular shape. Both the trajectory of the binary stars and the movement of two binary stars will be simulated, if the system can be established with a totally fixed star and the binary stars that will neither be attracted by the fixed star nor go further away from it.

What we will study?

After we finally reach the initial values that can establish a stable system, we will study how the fixed star will have impact on the trajectory of two binary stars rotating around each other. In addition, we will focus on how different parameters (including the mass of stars, velocity, distances, etc.) will affect the motion of these two stars. Since similar systems are believed to be rare in reality and has few records of discoveries, the result of the parameters may be achieved only under a very intense situation.

What steps to follow?

Here are the basic procedures that we may follow:

1. Make a draft about all the equations that we need such as the relationship between force and velocity, etc.
2. Set up some initial parameters and write codes. Parameters include mass of stars, the velocity of rotation of the binary system, the distance between each stars, etc.
3. Plot the result and see what are the trajectories of the binary stars like.
4. Change some parameters and repeat procedure 3.