

Today's Tutorial Goals

1. Run scattering experiments between single star and binary systems.
2. Scattering experiments between two binaries.
3. Convince yourself that these are chaotic interactions.
4. Play with impact parameter and velocity at infinity to see how the typical outcomes change.
5. Make a particular note of exchange outcomes. Do you see any mass dependence? Do you think that no matter whether BHs are initially single or not, they always exchange into stellar binaries by kicking out the typically lower-mass stars?
6. Make a stunning movie of binary-single and/or binary-binary interactions. Voted-best movie-maker(s) get chocolate. 😊😊

Essential Physics to Consider

1. These are chaotic orbits.
2. How often do they take place?
 - a. Rate $\sim n\sigma v \sim na^2v$
3. Needs large number of BHs in one place.
4. Needs high enough densities for it to happen at a high rate.

Fun things to think about:

1. In a burst of N stars, how many BHs form?
2. Is the total mass dominated by low-mass or high-mass stars?
3. Is there any other type of systems where this is exactly opposite?

Fun things to think about:

1. Consider two MS stars in a binary. Assume that they are 80 and 70 M_{\odot} . Assuming they make ~ 20 and 10 M_{\odot} BHs. Assume that the only physics to consider is mass loss in orbit. What is the merger time after the BHs form through GW radiation?