Summer Research:
Hypervelocity Globular Cluster

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How BH phase affects ejection velocity

- Need to only consider phase-space that results in captured globular cluster.
- If the GC does not achieve a distance of 120 pc after infall or takes too long to get there (makes more than one pass) final velocity is set to 0 km/s.
- Some energy from GC is transferred to BBH when it is captured.

BH Phase Dependent Exit Velocity of GC
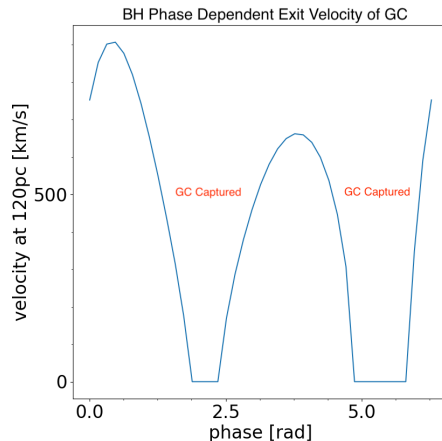
Energy Evolution of bound GC
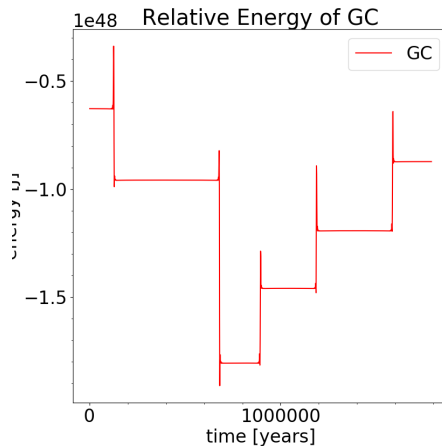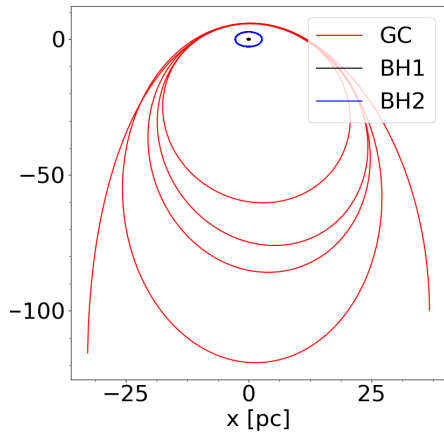
Energy Evolution of unbound GC
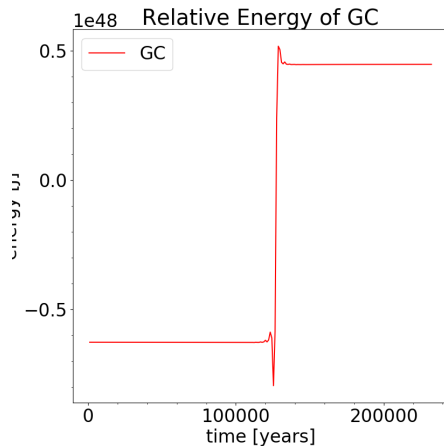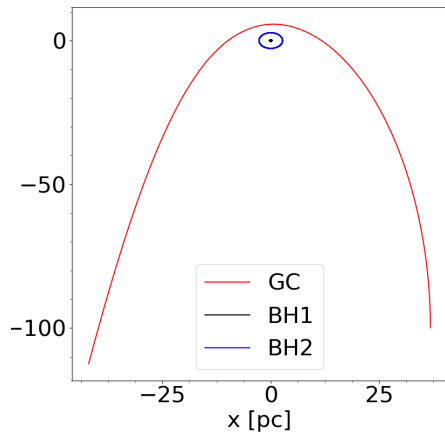
Operational Parameters

- Input:
    - Black holes: Mass ratio (1:100, 1:20, 1:10), separation (1.7, 3, 5) parsecs
    - Globular Cluster: Closest approach (1.5, 2, 2.5) times BH separation
- For each combination of operational parameters, cycle through initial black hole phases 0 to 2pi in steps of pi/20. 1000 individual simulations, 7.5 min runtime.
- Outputs any velocity of ejected GC > 1000 km/s, maximum tidal acceleration experienced, all operational params.
  (1108.74765364, 0.05, 1.7, 1.5, 0.785398163397)
- Interesting things: ZERO simulations with closest approach 2 or 2.5x BH separation and ZERO eith 0.01 BH mass ratio resulted in hypervelocity.

Analysis to find optimum path

- "Optimum path" meaning the interaction that results in highest ejection velocity and a low tidal acceleration.
- Want to find how far away from black hole binary the GC can get while still achieving a > 1000 km/s velocity:
    - Repeat simulation set with new operational parameters.
    - Calculate tidal radius & acceleration for each run.

Backup Slides

3:1 Mass ratio

- 2-3 pc pass from larger BH.
- Tidal radius of 0.3-0.4 pc