Summer Research: Hypervelocity Globular Cluster

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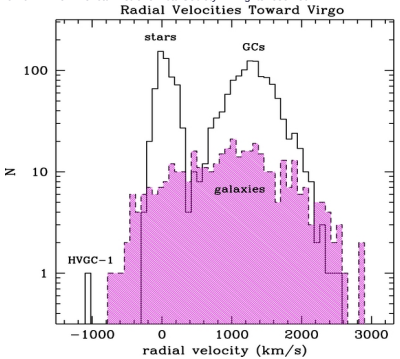
M87

Identification of HVGC-1

- Caldwell et al. 2014
- Extremely blue-shifted object in M87
- Low metallicity, emission spectrum well within expected for GC.

Figure 1. from A Globular Cluster toward M87 with a Radial Velocity < – 1000 km s–1: The First Hypervelocity Cluster
Caldwell et al. 2014 ApJL 787 L11 doi:10.1088/2041-8205/787/1/L11
http://dx.doi.org/10.1088/2041-8205/787/1/L11

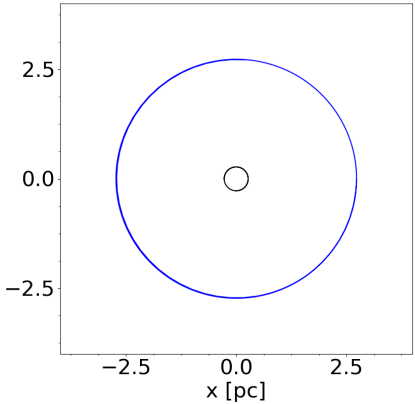


Possible mechanisms for acceleration

- HVGC-1 received kick from potential well of merging dark matter halos.
  - Samsing 2015
- Kick from interaction with a supermassive binary black hole.
  - Survival of an extended Globular Cluster has not been simulated/investigated.

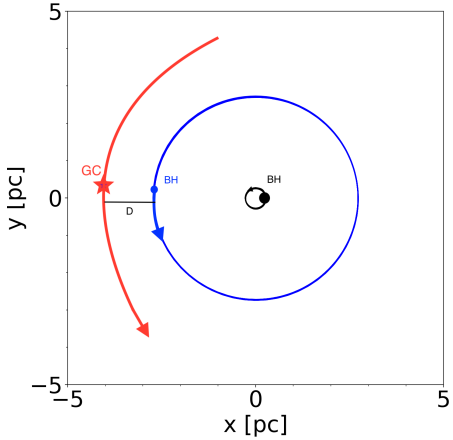
Blackhole circular orbits.

- Can set any BH mass ratio and separation.
- Caldwell calls for HVGC-1 to pass 1pc from 10:1 ratio BBH.



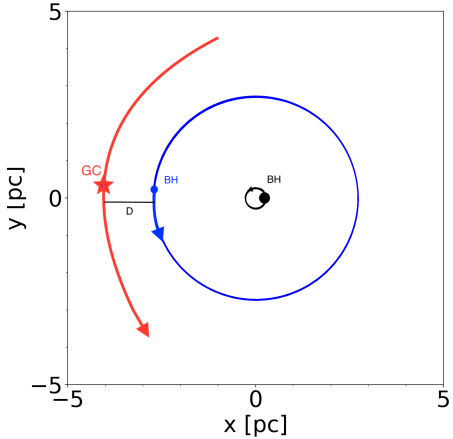
10:1 Mass ratio: HVGC-1 Pass

- Perturbation: $\gamma = \frac{M_{bbh}}{M_{GC}} \left(\frac{R}{D}\right)^3$
- Minimize γ while still producing a hyper-velocity object.
- Prograde-planar interaction.



Next Steps - 10:1 Mass ratio: HVGC-1 Pass

- Input params: GC starting position (closest approach), BH separation, BH mass ratio
- Output: Velocity of GC, max perturbation experienced.
- Tidal radius of 0.1pc
- Cluster $r_h = 6$pc



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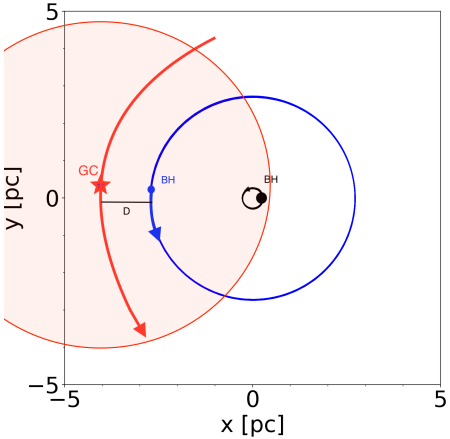

Questions and Preparing for Meetings

- Make Slack channel for astrophysics group?
  - Useful for quick questions, document sharing.
- Continue making slides for weekly meetings.
  - Helpful for making progress and developing presenting skills.
  - Allows entire group to be involved, up-to-date, and able to provide informed advice.

Backup Slides

3:1 Mass ratio

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