

# Summer Research: Hypervelocity Globular Cluster

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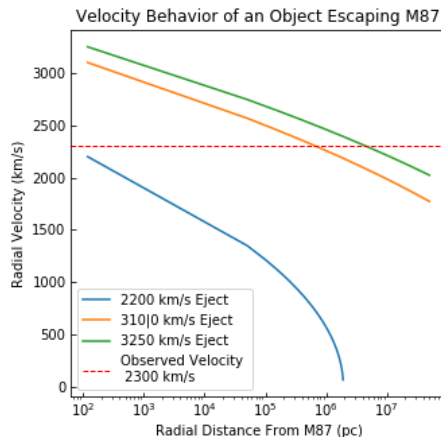
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# HVGC-1 Radial and Tangential Velocity

- HVGC-1 observed to have 2300 km/s radial velocity towards earth.
- Tangentially removed from M87 by 85 kpc.
- Must have some tangential velocity component (probably small compared to radial velocity less the object is more extraordinary than it already is).
- Tangential velocity determines how long HVGC-1 has been traveling. We are limited here as M87 is 16.4 Mpc away and observations assumed HVGC-1 was also 16 Mpc away.

## Necessary Ejection Velocities

- Took two scenarios: HVGC-1 has traveled 1.5 Mpc radially from M87 and 6.5 Mpc.
- Corresponds to tang. velocities of 1-5% of total vel.
- See right: evolution of radial velocity as cluster travels away from M87.
- Green + Orange: extremes of most likely behavior, total ejection velocity of 3300 km/s. Blue: Minimum radial velocity to leave cluster unbound from M87, total ejection 2400 km/s.



## Two Simulated Encounters of Interest

- Ejected: 3400 km/s, Tidal Perturbation: about 100,000 times internal acceleration
- Ejected: 2400 km/s, Tidal Perturbation: about 13,000 times internal acceleration

# Backup Slides

## 3:1 Mass ratio

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

