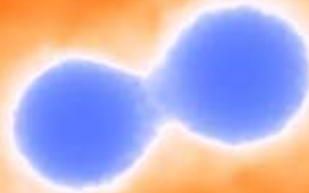


Runaway Collisions and Multiple Populations in Globular Clusters



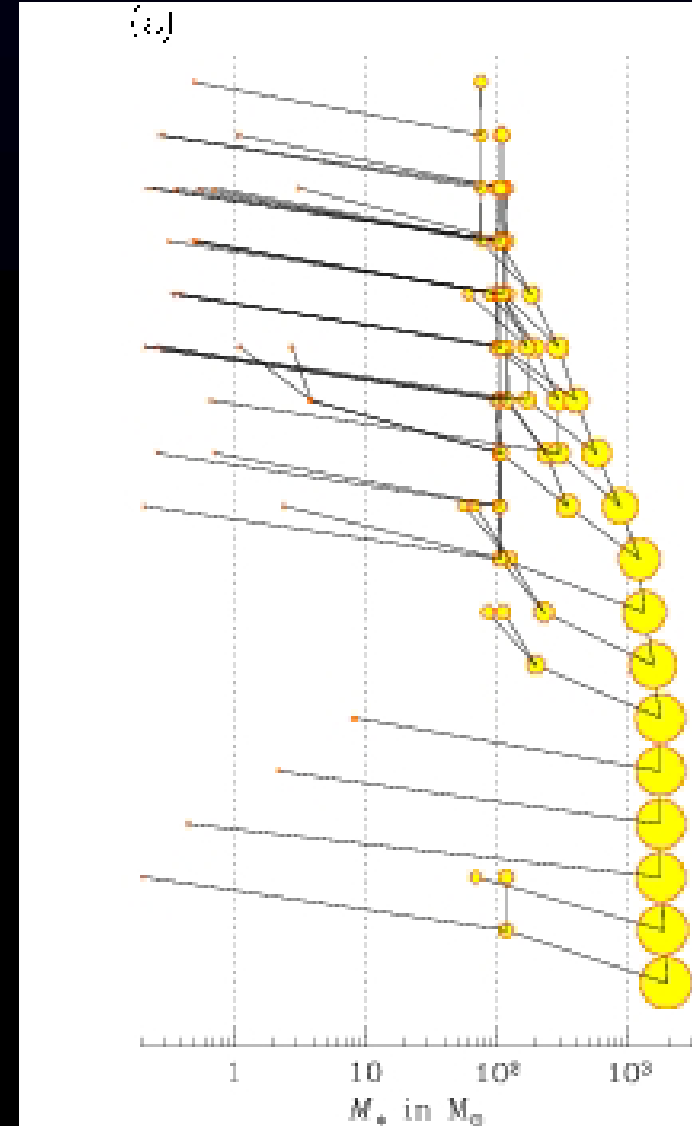
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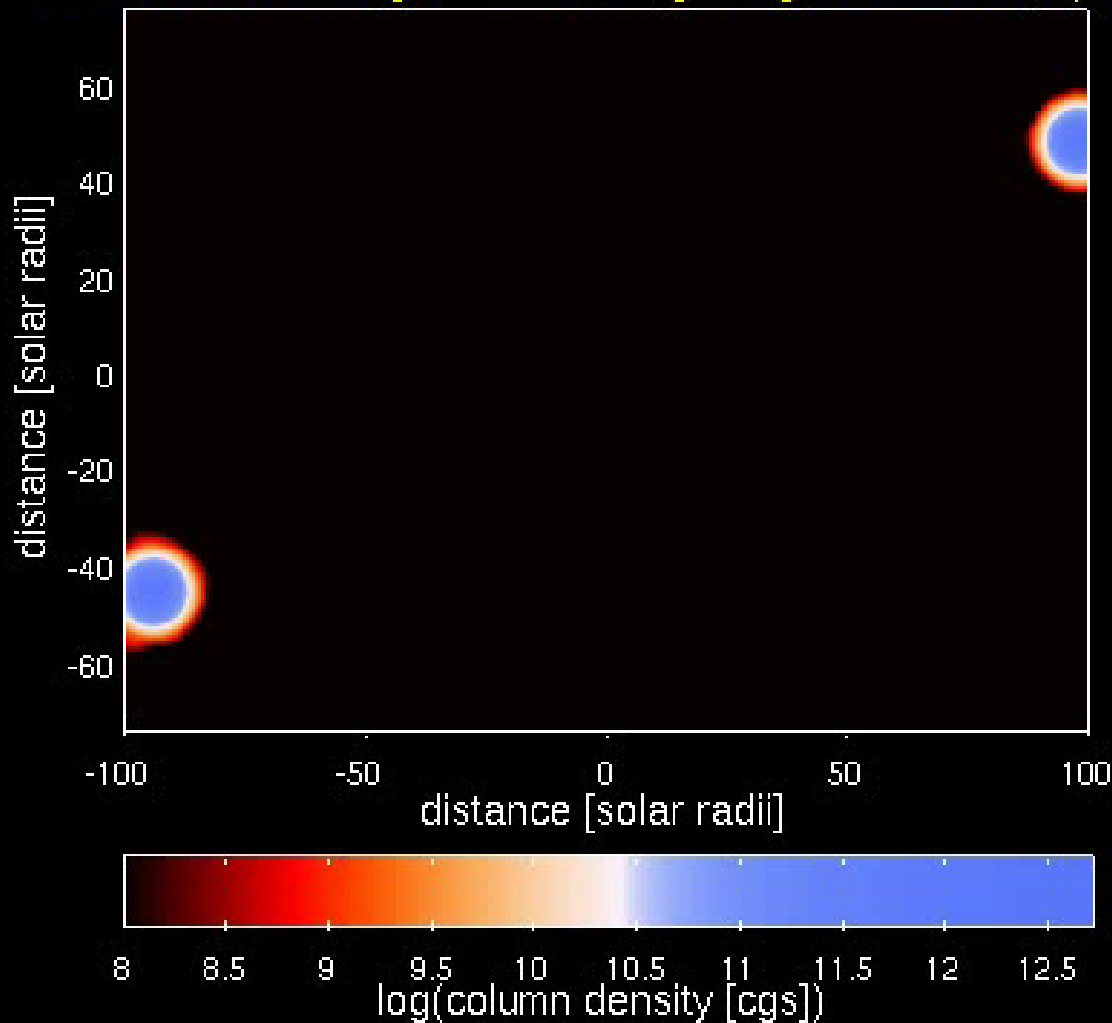
Simulated cluster scenario

- With SPH, we follow collision sequence from very dense simulated cluster K3-37 of Freitag, Gurkan, & Rasio (2006).
 - Salpeter mass function from 0.2 to 120 solar masses.
 - Runaway occurs when collision timescale of the most massive stars is less than their main sequence lifetimes ($\sim 3\text{Myr}$). In K3-37,
 - runaway snowballs after 1.85 Myr.
 - 100 collisions contribute to final runaway collision object (RCO).



Collision 61 (3rd in chain)

time $t=0.00$ days viewing angles: $\theta=70^\circ$, $\phi=323^\circ$

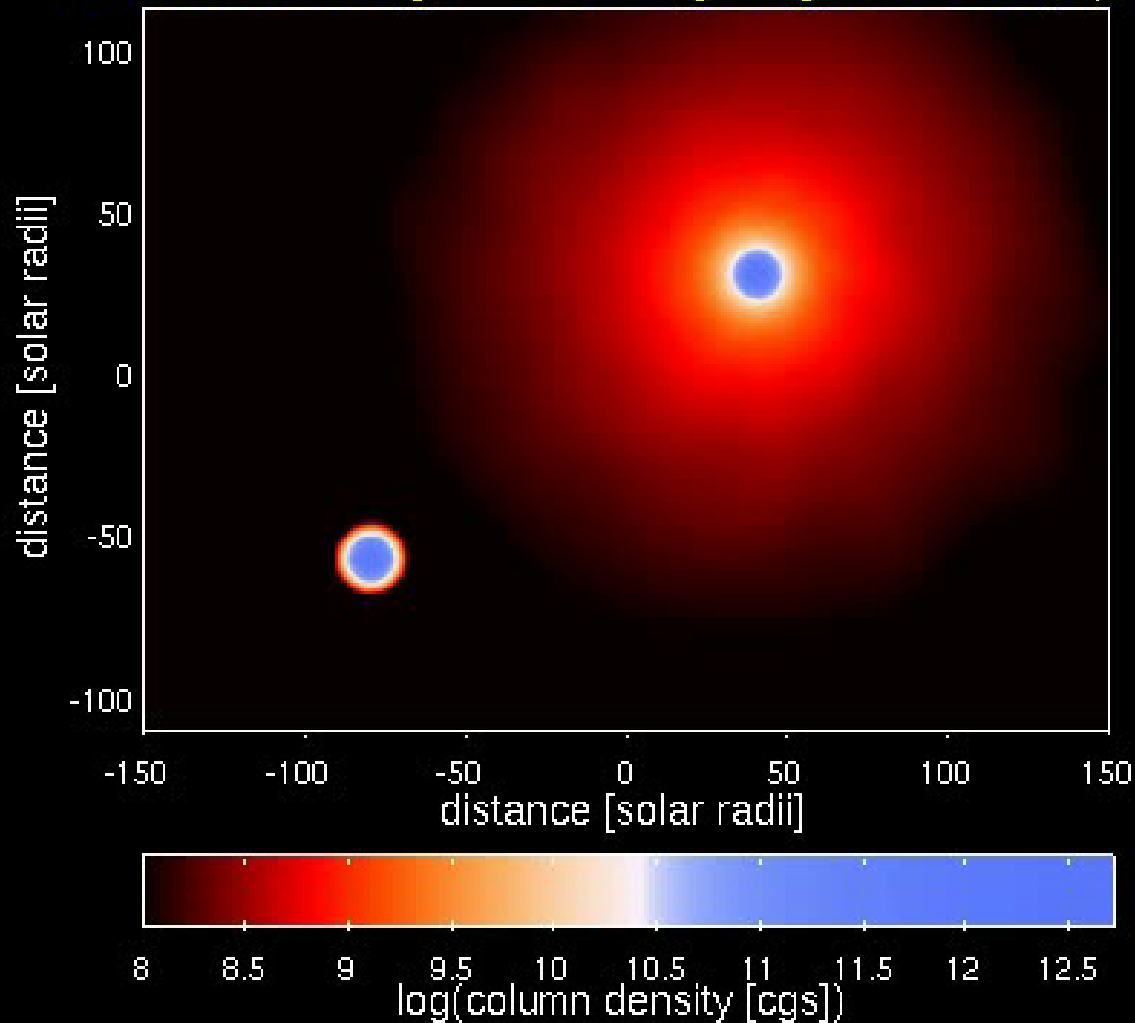


- Time = 1.8 Myr
- $106 M_{\odot}$ RCO + $111 M_{\odot}$ RCO
- $r_p = 8 R_{\odot}$, $v_{rel} = 69$ km/s

- RCO mass = $208 M_{\odot}$
- 4% mass loss, which comes nearly equally from the parent RCOs

Collision 71 (4th in chain)

time $t=0.00$ days viewing angles: $\theta=70^\circ$, $\phi=323^\circ$

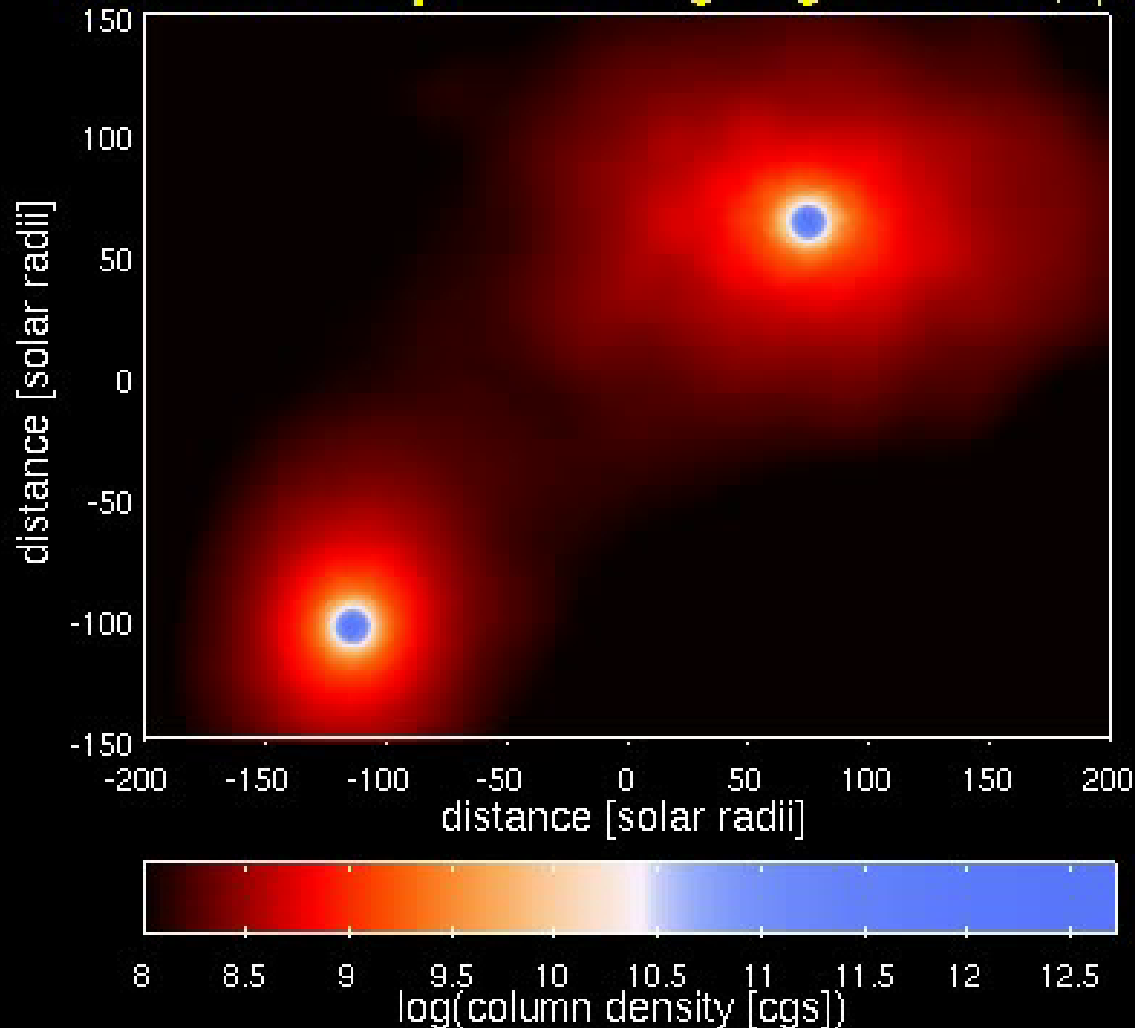


- 50 kyr after collision 61
- $208M_{\odot}$ RCO + $109M_{\odot}$ RCO
- $r_p = 16R_{\odot}$, $v_{rel} = 99$ km/s

- RCO mass = $258 M_{\odot}$
- 19% mass loss, which mostly comes from the larger parent

Collision 73 (5th in chain)

time $t=0.00$ days viewing angles: $\theta=70^\circ$, $\phi=323^\circ$

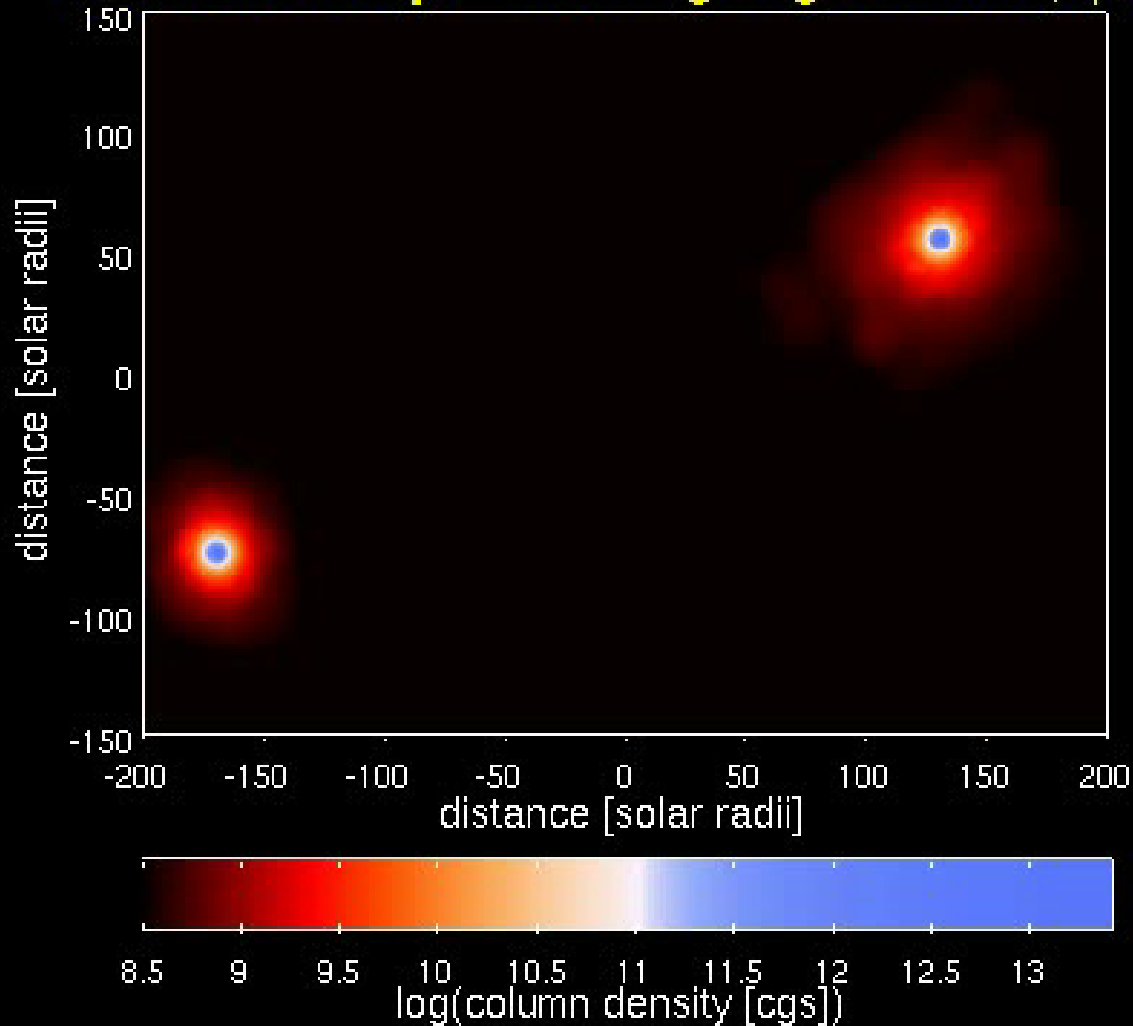


- 10 kyr after collision 71
- $258M_{\odot}$ RCO + $163M_{\odot}$ RCO
- $r_p = 41R_{\odot}$, $v_{\text{rel}}=41$ km/s

- RCO mass = $298 M_{\odot}$
- 29% mass loss, which comes more from the larger parent

Collision 74 (6th in chain)

time $t=0.00$ days viewing angles: $\theta=70^\circ$, $\phi=323^\circ$



- 100 yr after collision 73
- $298M_{\odot}$ RCO + $227M_{\odot}$ RCO
- $r_p = 7R_{\odot}$, $v_{rel} = 72$ km/s

- RCO mass = $357 M_{\odot}$
- 32% mass loss, which comes nearly equally from the parents

