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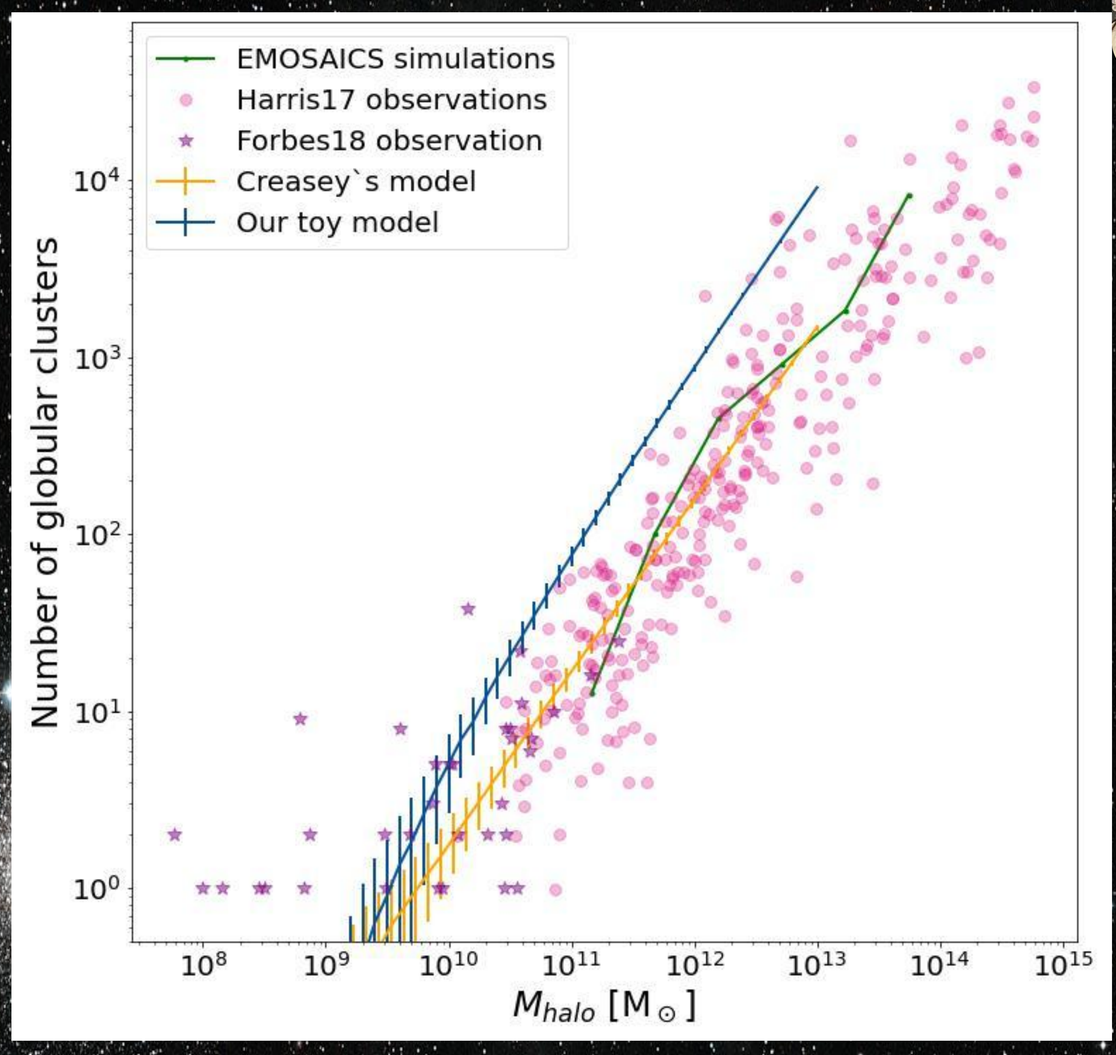
Primordial globular cluster formation models could explain globular cluster number – halo mass relation

Can we know anything about **globular cluster formation** by studying globular cluster - host halo relation?

Take-home points

- Primordial globular cluster (GC) formation proposed that GCs can formed inside their own dark matter halos.
- Primordial GC models could predict the observational relation of GC number-halo mass, on high mass halos.
- Future works:
  - developing our primordial GC model to explain the shallow slope on low-mass halos,
  - considering GC disruption,
  - accepting second formation channel dominates on the high mass end.

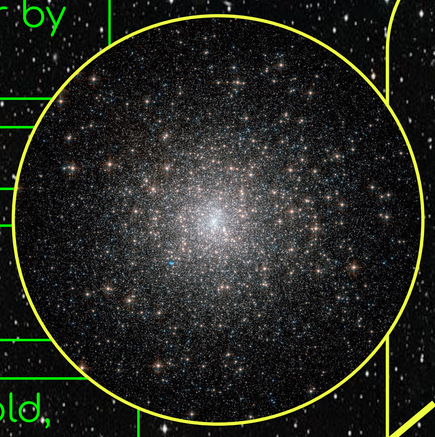


GCs are groups of thousand-million old stars (>10 Gyr), bound together by gravitational force;

Spherical in shape (r~1-10 pc);

Found in almost all galaxies that $M_\star > 10^9 M_\odot$;

Classified: young, metal-rich and old, metal-poor GCs.



Primordial GC formation

- GCs formed inside their own dark matter halos;
- Introduced by Peeble & Dicke (1968), studied in Creasey et al. (2018);
- **Potentially describe the presence of GCs in low-mass halos**, hard to explain how dark matter gone after GC formed;

GC co-formation with galaxy

- GCs formed and evolve together with host galaxies;
- Studied in EMOSAICS simulations;
- Failed to explain GCs in low halo mass;

Conditions for halos to form primordial GCs

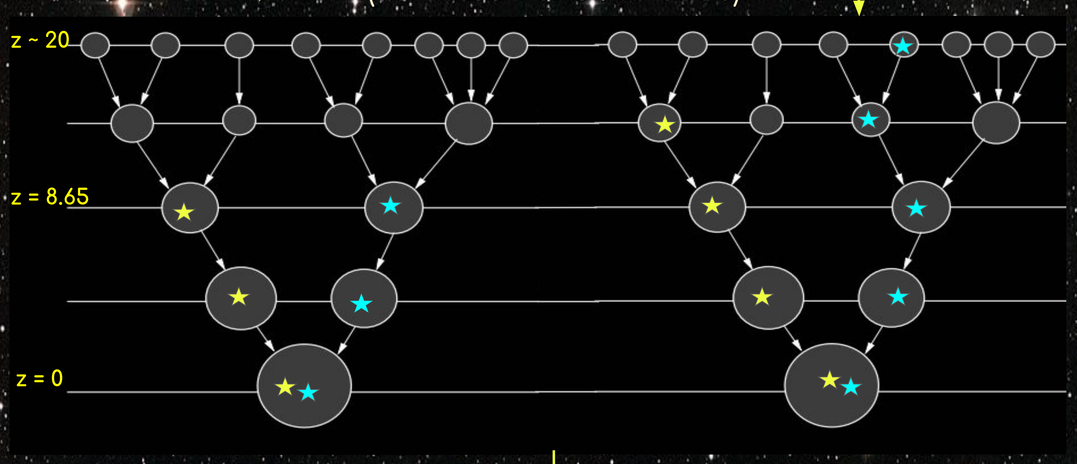
Creasey's model

$$\begin{cases} z = 8.65 \\ M_h \geq 10^8 M_\odot \end{cases}$$

Our toy model

$$\begin{cases} z \geq 8.65 \\ M_h \geq 10^8 M_\odot \end{cases}$$

Extended Press-Schechter method (Parkinson et al. 08 code)



Maximum number of GCs in halos at z = 0

Discussion

- Our primordial GC model (blue line) reproduce the maximum number of GC in halos at high mass, but fail to explain that on low-mass end.
- Creasey's model (orange line) explains the high mass slope better but requires an identical formation time for all GCs - which is less physical meaning.
- Adding GC disruption could explain the shallow slope on the low mass end but requires fine-tuning on higher mass halos.

References

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