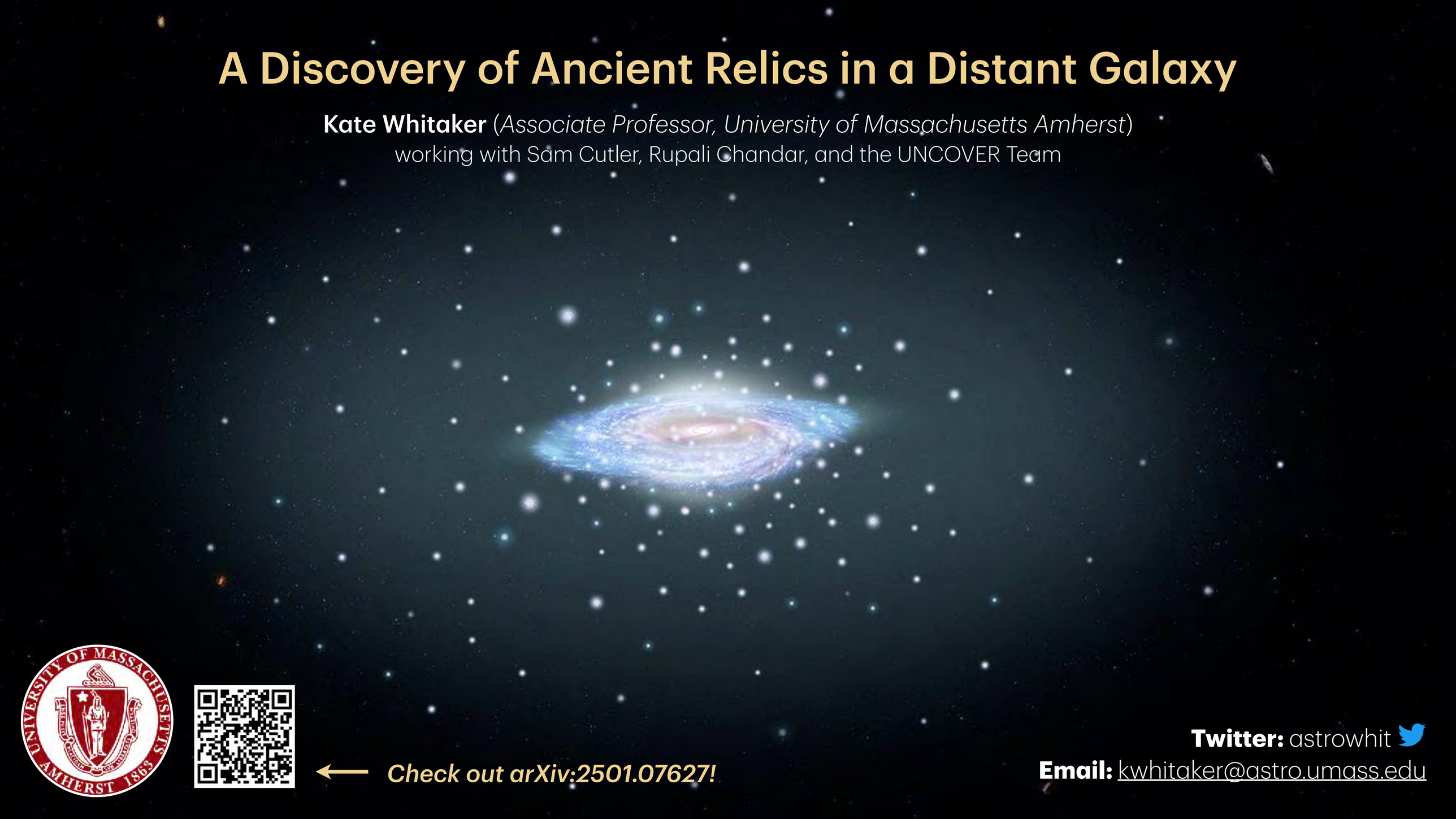
A Discovery of Ancient Relics in a Distant Galaxy

Kate Whitaker (*Associate Professor, University of Massachusetts Amherst*)
working with Sam Cutler, Rupali Chandar, and the UNCOVER Team



Check out arXiv:2501.07627!

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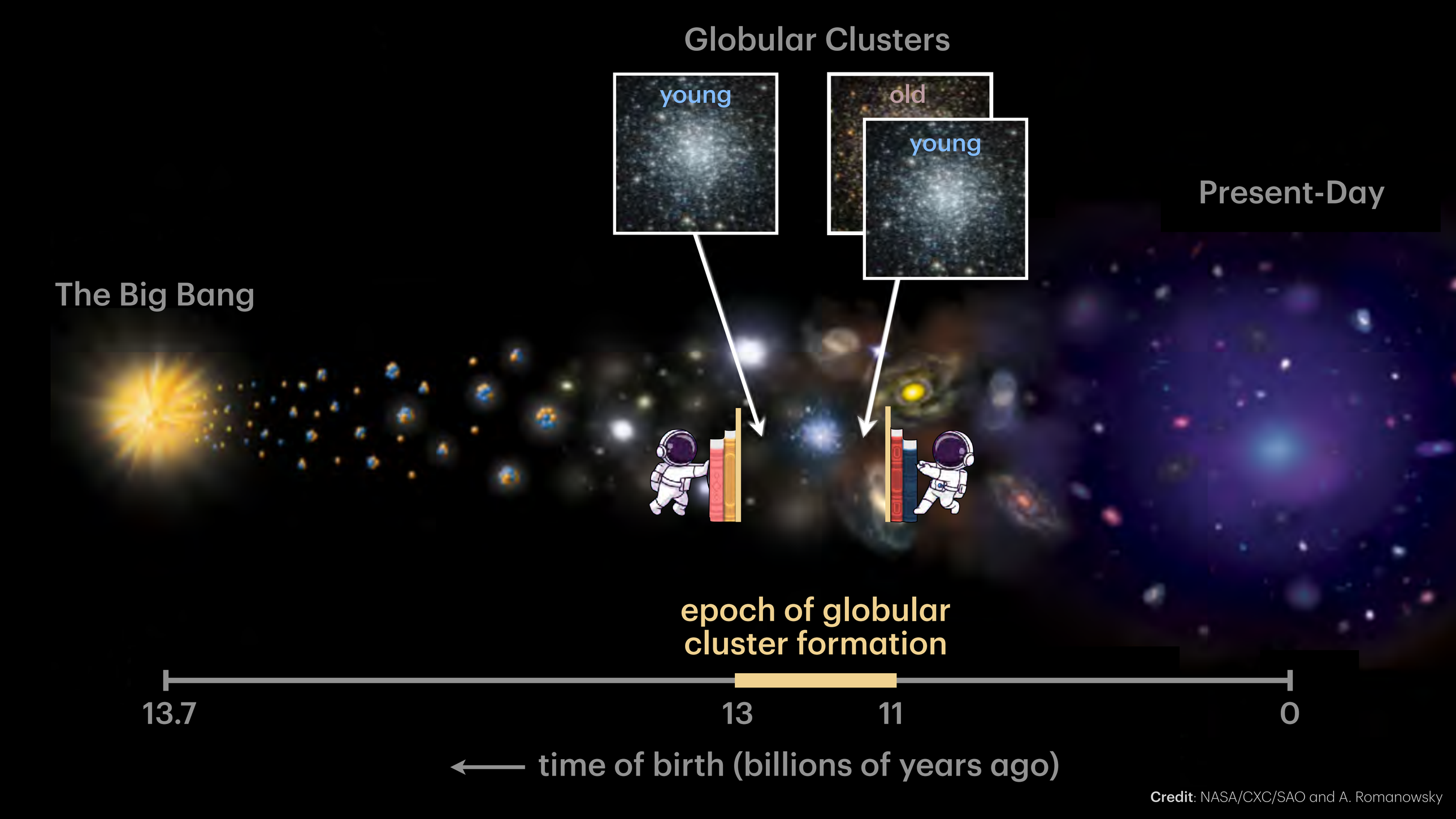
Messier 92 (M92)

Credit: NASA, ESA, Gilles Chapdelaine

M92 was first discovered in 1777 and the individual stars first resolved in 1783 by William Herschel

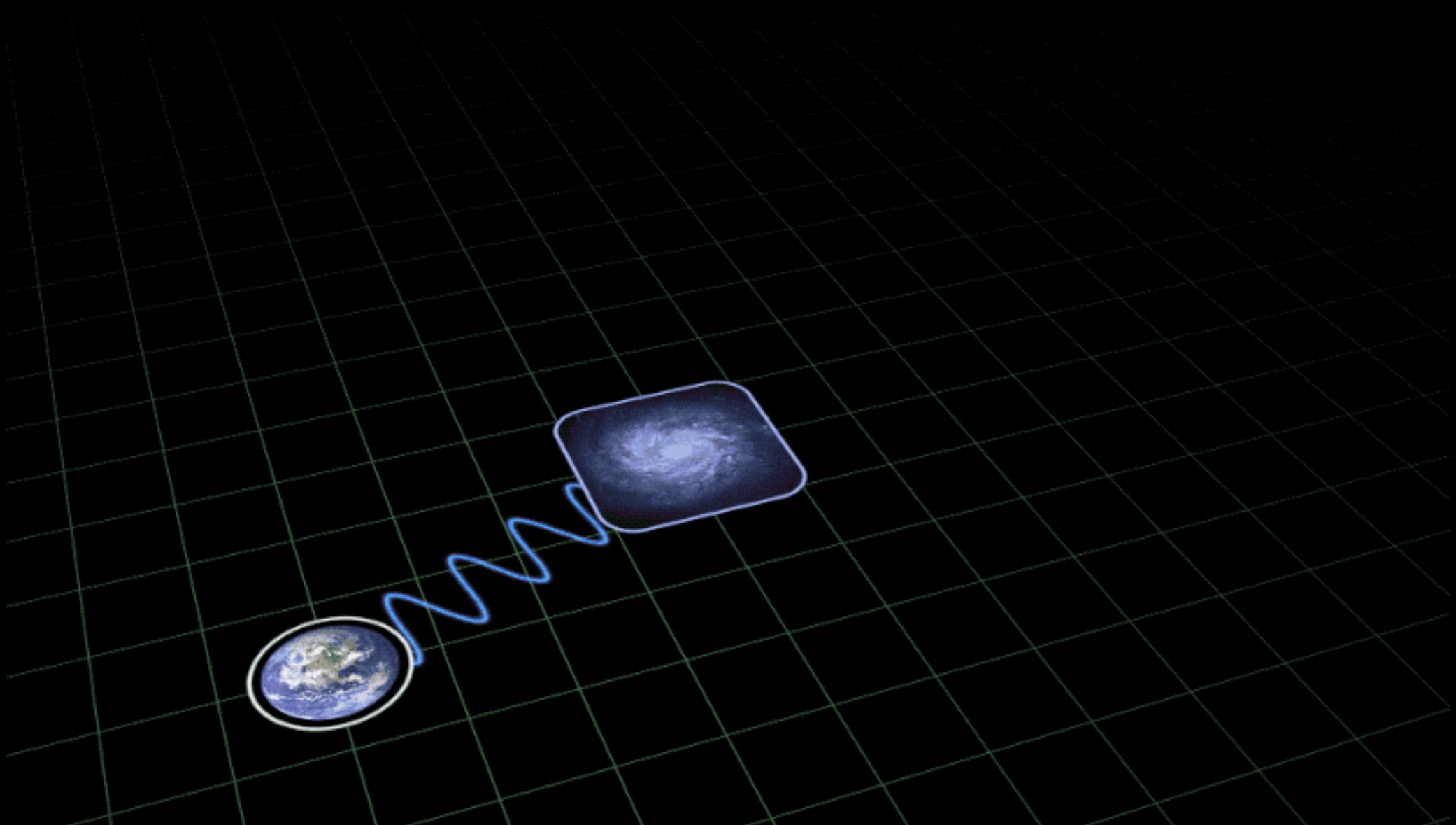
... but *how* and *when* did globular clusters form?



Credit: NASA/CXC/SAO and A. Romanowsky

As Light Travels In An Expanding Universe, It Stretches and Gets Redder

and by looking at objects farther away, due to the *finite speed of light*, we also can look further back in time!




UNCOVER & MEDIUM BANDS:
MEGASCIENCE

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(Swinburne)

Rachel Bezanson
(Pitt)

Wren Suess
(CU Boulder)

Sedona Price
(Pitt)

G. Brammer
(DAWN)

Danilo Marchesini
(Tufts)

Richard Pan
(Tufts)

Kate Whitaker
(UMass)

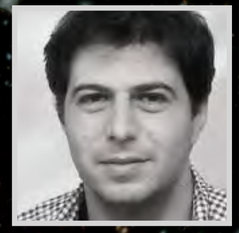
John Weaver
(UMass)

Sam Cutler
(UMass)

Bingjie Wang
(PSU)

Joel Leja
(PSU)

Lukas Furtak
(Ben Gurion)



Adi Zitrin
(Ben Gurion)

And many others!

Hakim Atek
Adam Burgasser
Dan Coe
Iryna Chemerynska
Pratika Dayal
Pieter van Dokkum
James Esdaile
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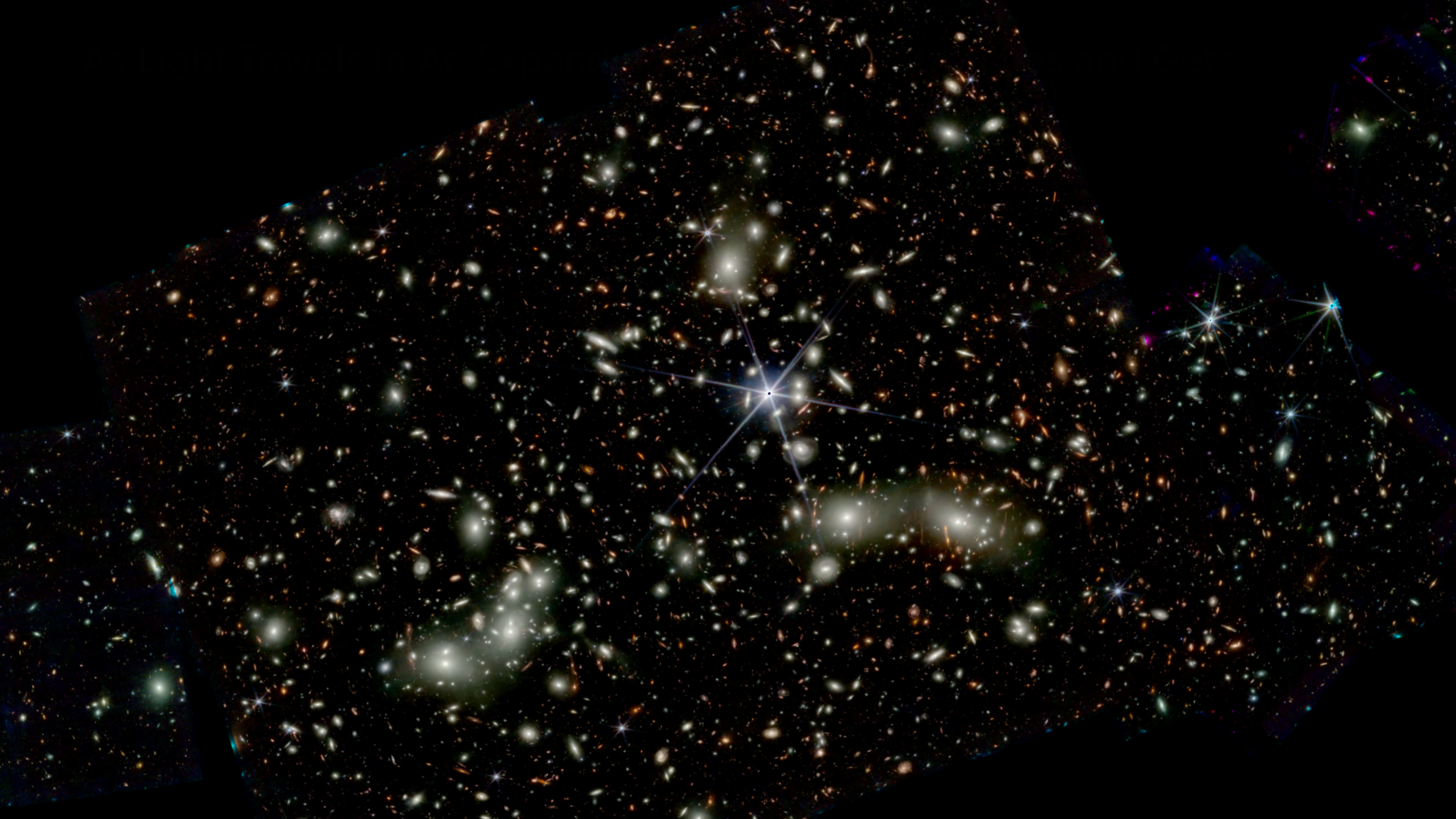
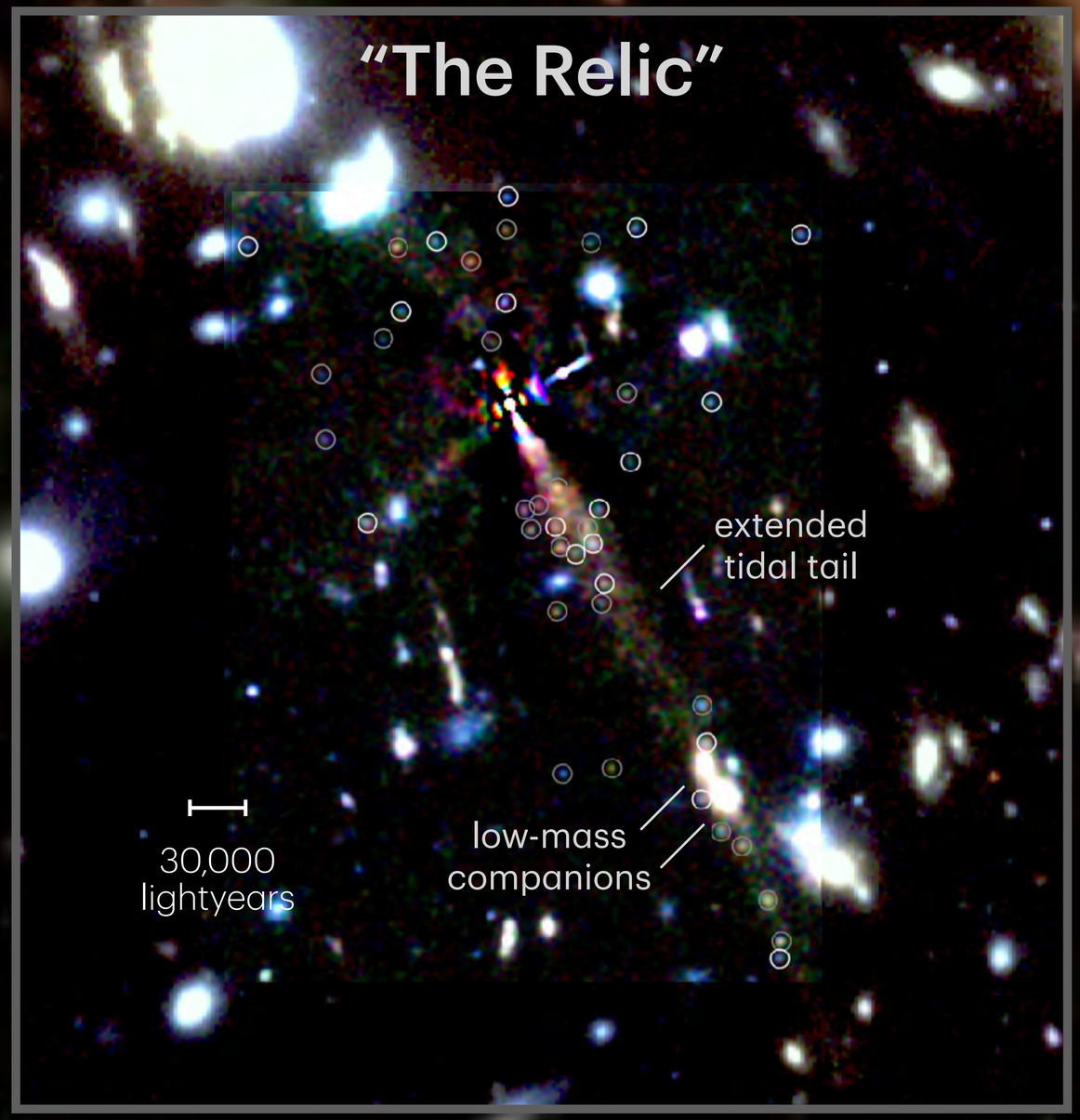
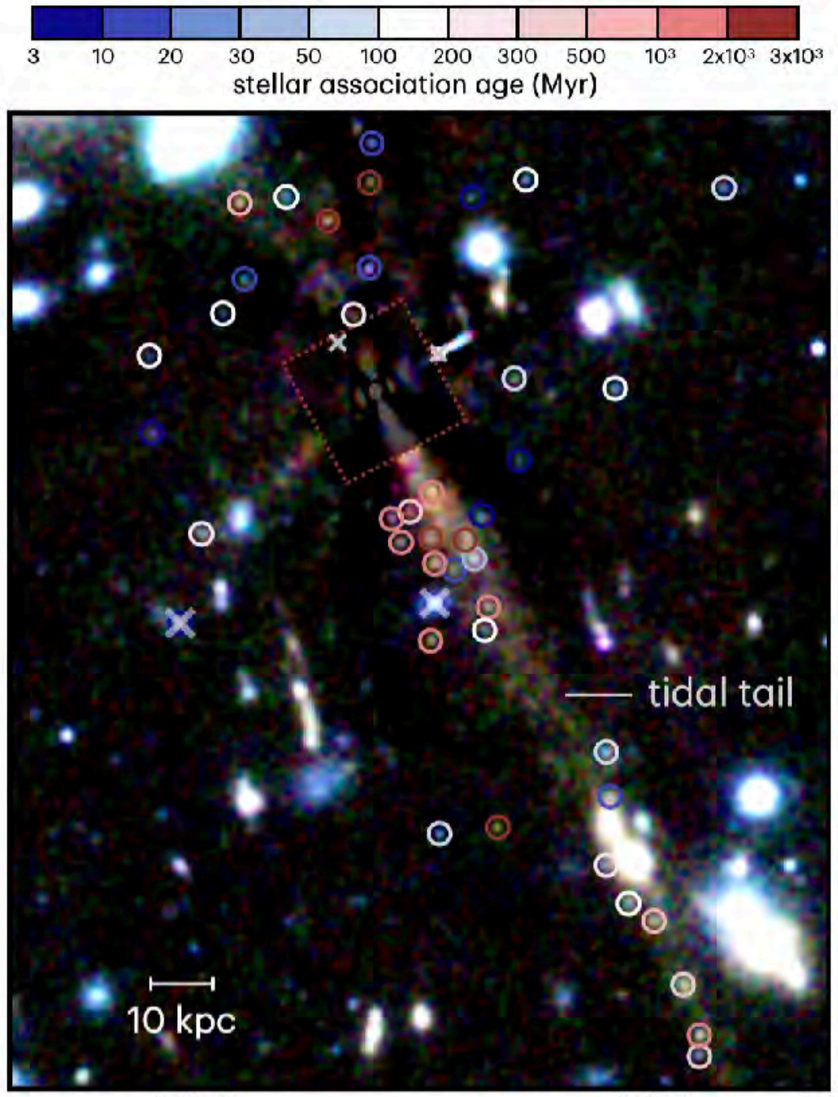
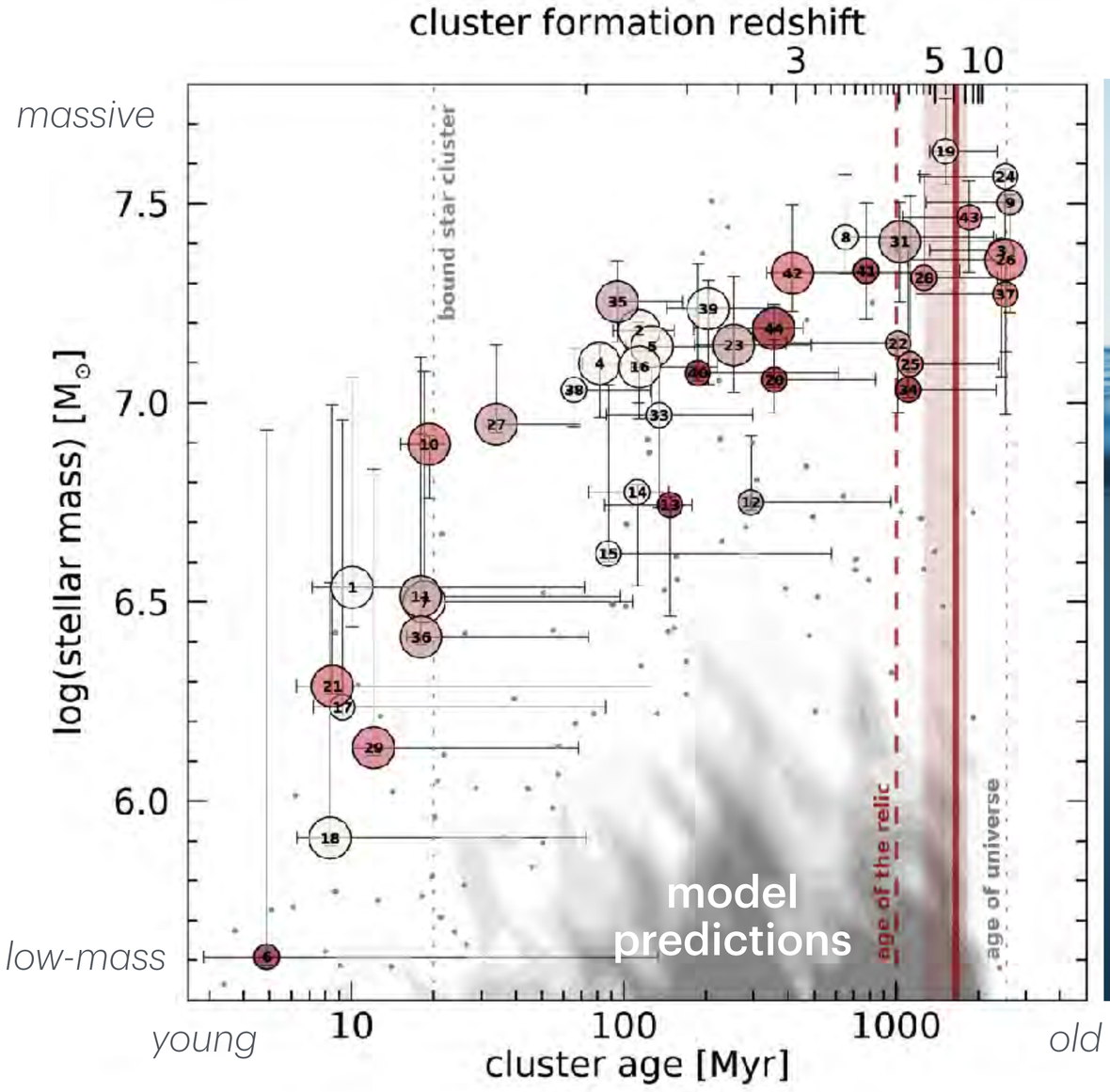



“The Relic”
extended
tidal tail
30,000
lightyears
low-mass
companions

Discovery of star clusters when the Universe was only 2.5 billion years old!

A population of young, intermediate, and old clusters caught during the epoch of globular cluster formation





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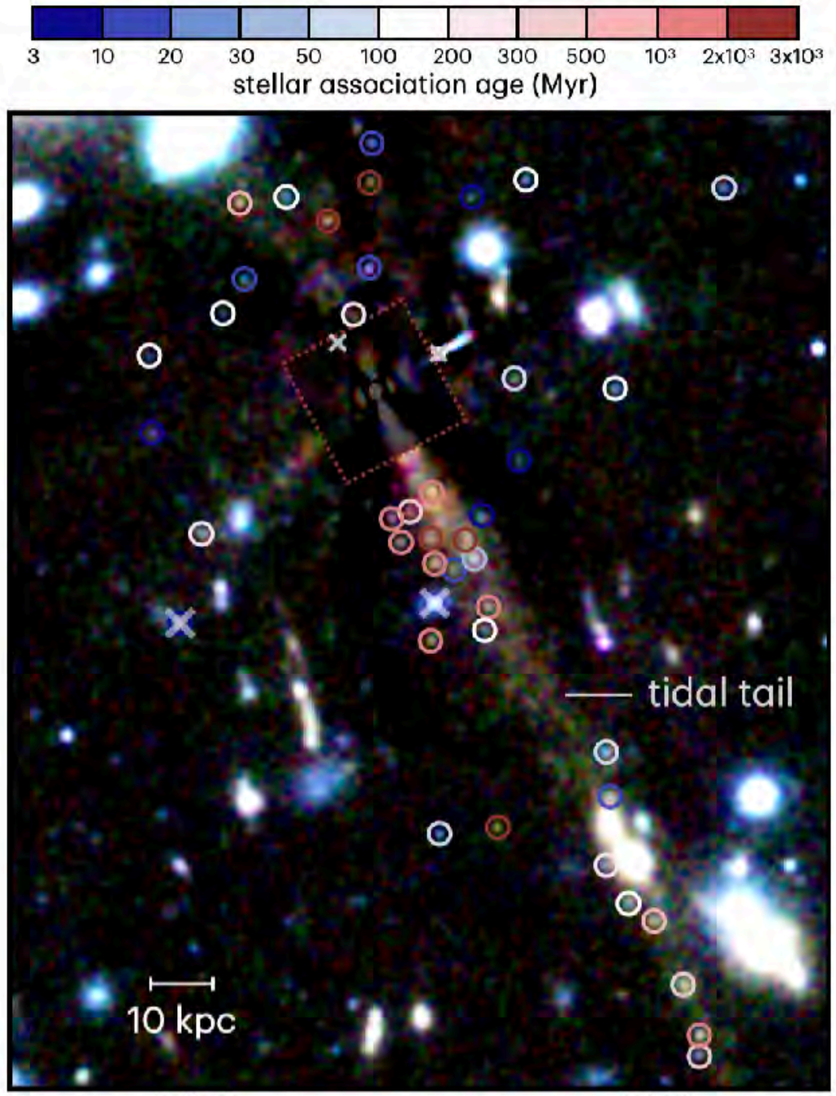

Formation History of 'The Relic'

- **The Relic hosts over a dozen of the best known examples of nascent globular cluster candidates, consistent with the largest formed in model predictions.**

... and stay tuned for upcoming spectroscopic data!

JWST-GO-6405 PI: Cutler (& Whitaker)

- **Relic clusters support a picture of past merging, in-situ formation, and late-stage accretion events:**
  - **Oldest (>1 Gyr) clusters** likely **formed in-situ** in tandem with the bulk of the host galaxy.
  - **Intermediate-age (100-500 Myr) clusters** are result of **tidal interaction** and **accretion** events.
  - **Young clusters (10-100 Myr)** likely also **accreted**.

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