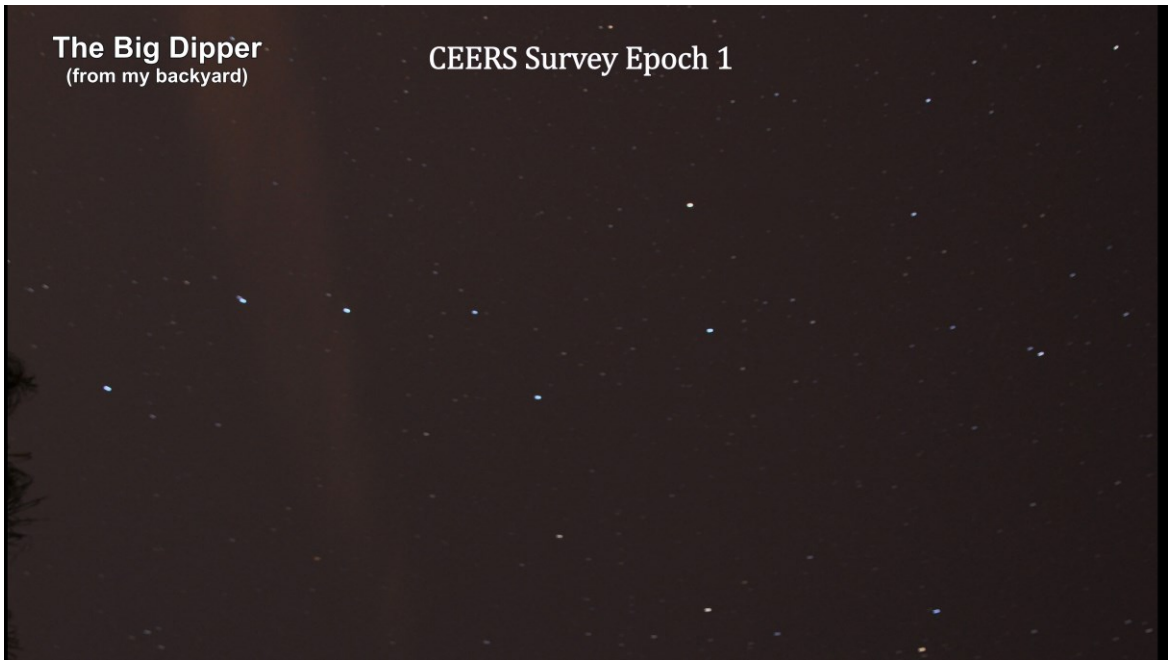
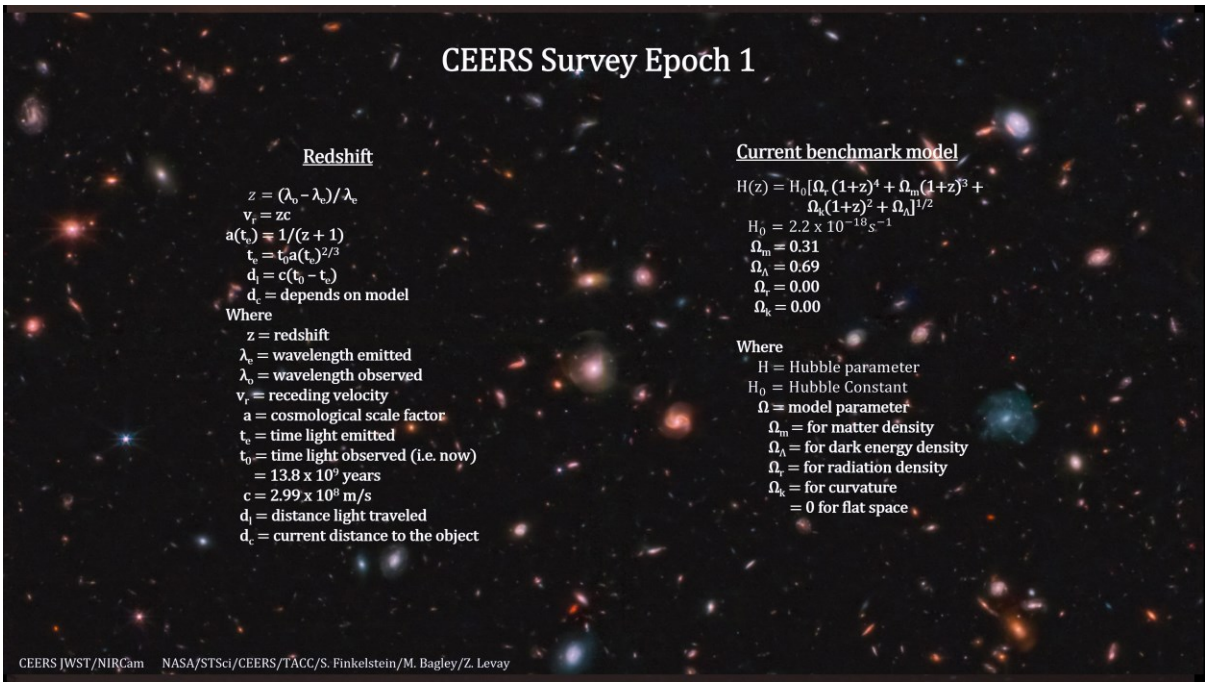
JWST CEERS First Images Release

The James Webb Space Telescope organization partners with a large number of other scientific organizations around the world to help identify the areas to observe and to help evaluate the resulting images and data. One of these is the Cosmic Evolution Early Release Science Survey (CEERS) working with Webb on analyzing the early universe. They had Webb train its Near Infrared Camera on a patch of sky near the handle of the Big Dipper. The area analyzed is around eight times larger than Webb's First Deep Field Image.

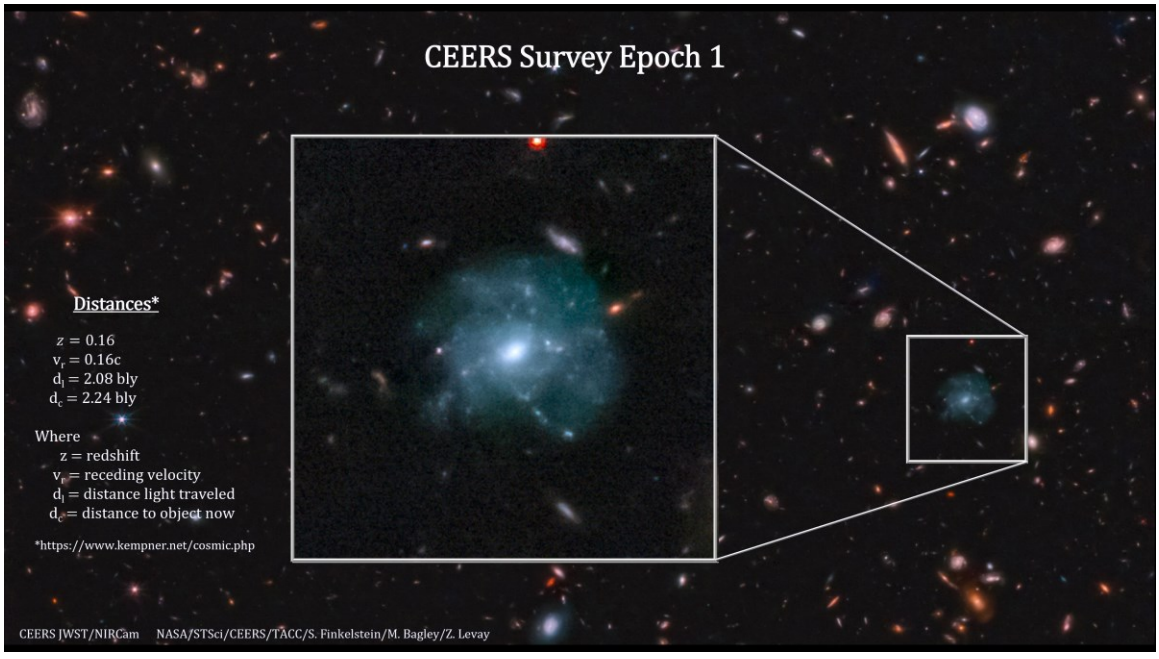


Here's one of several released panels. When the light we see from these objects started, the Universe was a lot smaller than it is now. The object of this exercise, and one of Webb's primary goals is to verify or challenge the current Benchmark Model for the age and expansion of the Universe – the Lambda Cold Dark Matter Big Bang Theory. For this reason, you'll find that only 'redshift' numbers are provided by CEERS for all observed objects instead of distance. This is because distance calculations depend entirely on the model under investigation. For reference purposes, I'll provide distances based on the current model.

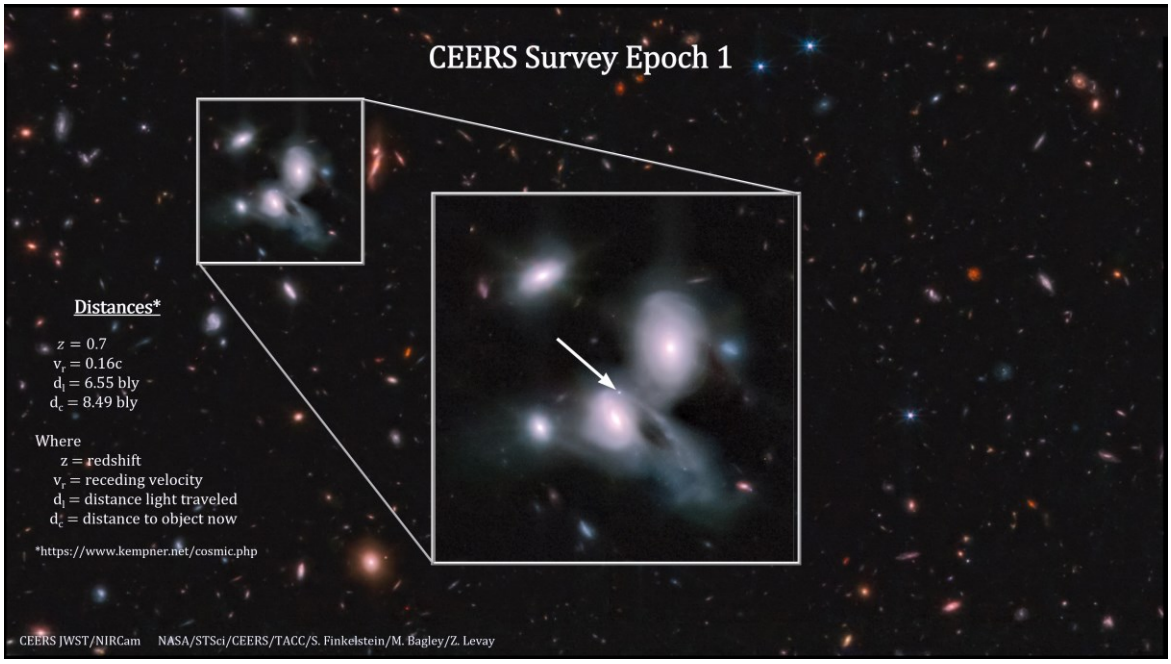
[Redshift gives us an object's receding velocity. It also gives us the actual cosmic scale factor at the time the light was emitted. In addition, it gives us the age of the universe at the time the light was emitted, and therefore the amount of time the light was traveling. Plus, with a given expansion model, it gives us the distance to the object at the current time, and the distance to the object at the time the light was emitted. You can see why astronomers rely so heavily on redshift measurements.]



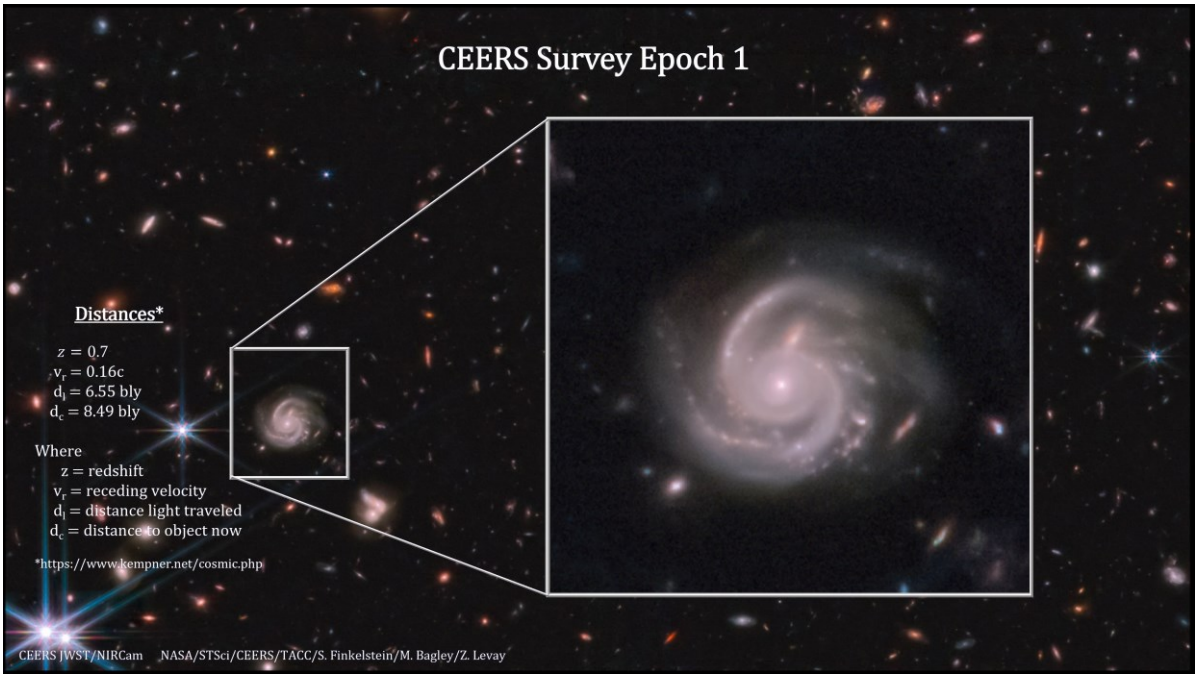
In this panel, we focus on a spiral galaxy with a large number of blue star-forming clumps and star clusters. Its redshift is z = 0.16. The redshift gives us the distance the light from this galaxy traveled at 2.08 bly. And, with the benchmark model, we get the distance to that galaxy today at 2.24 bly.



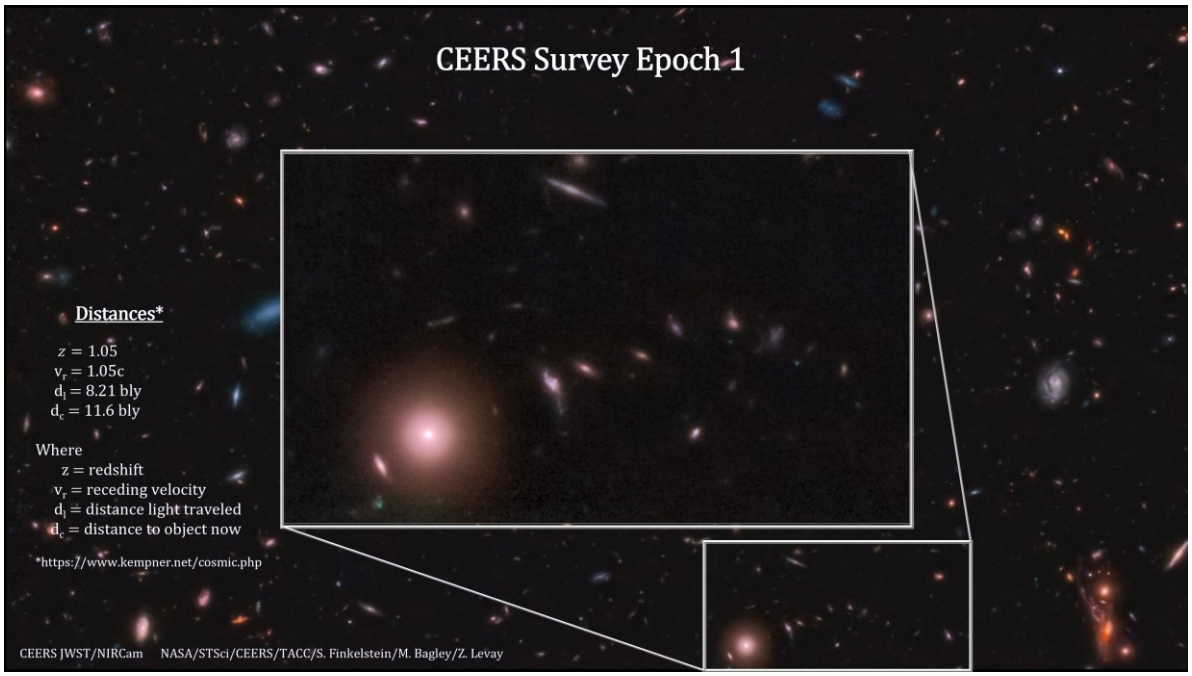
Here's another panel. It contains two interacting spiral galaxies at z = 0.7. The light from these galaxies traveled 6.55 bly to reach us. They are now 8.49 bly away from us. The arrow points to a supernova.



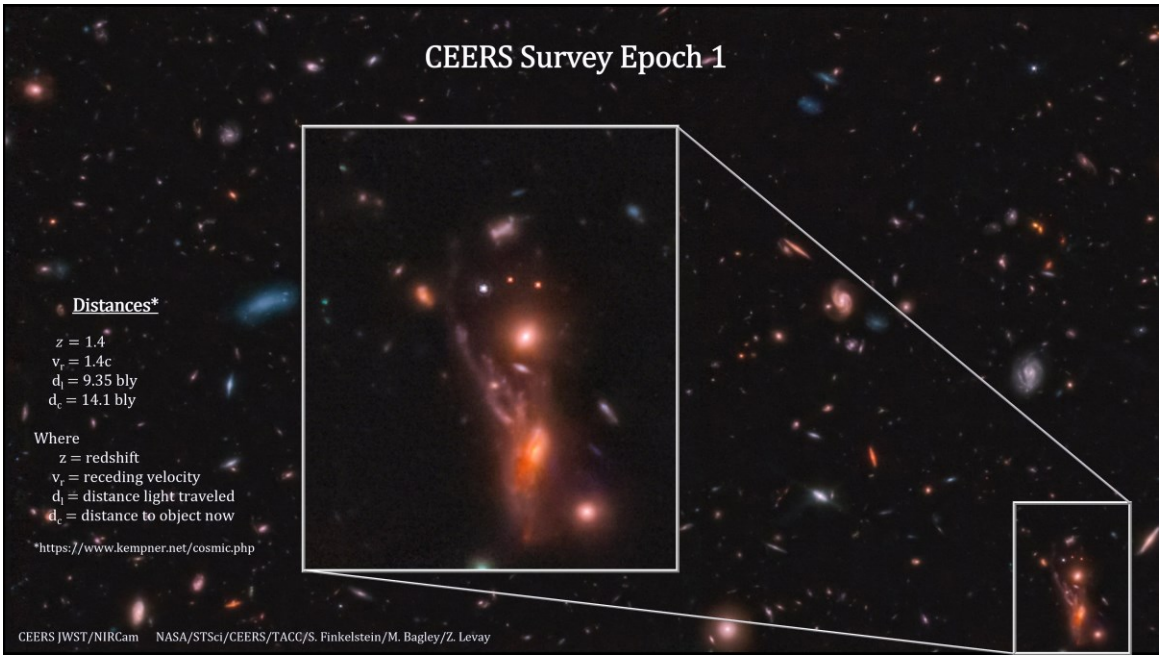
Here's another spiral galaxy in the same panel, also at z = 0.7. It highlighting Webb's ability to resolve small-scale features even for modestly distant galaxies.



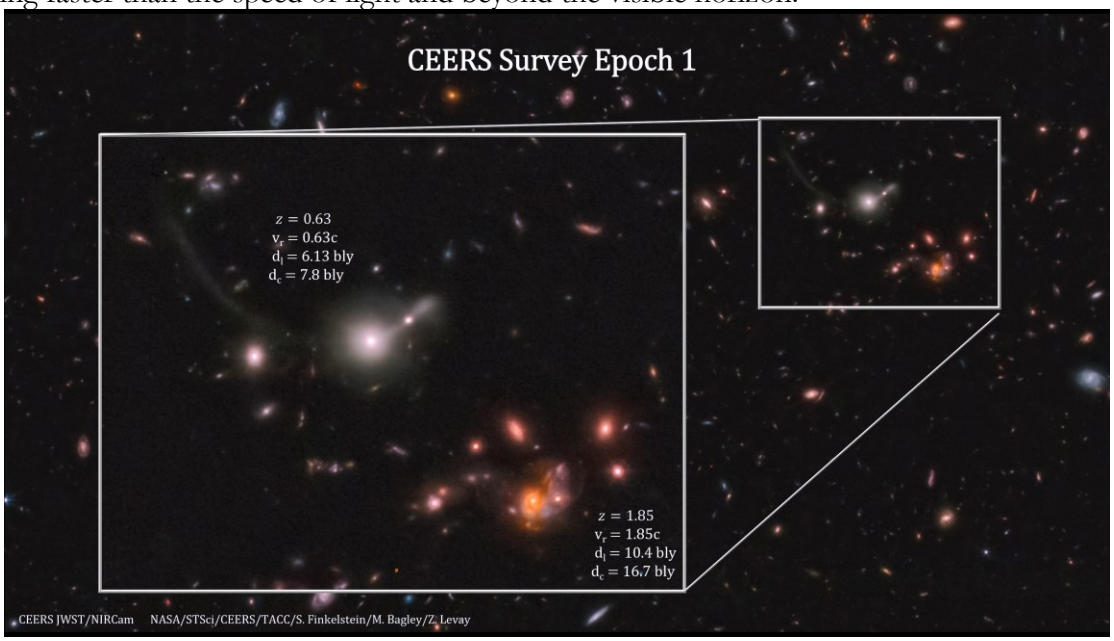
In this panel, we have a chance alignment of a bright galaxy with several smaller galaxies forming an arc to the right. It's light traveled 8.21 bly to reach us, and the galaxy is now 11.6 bly away.



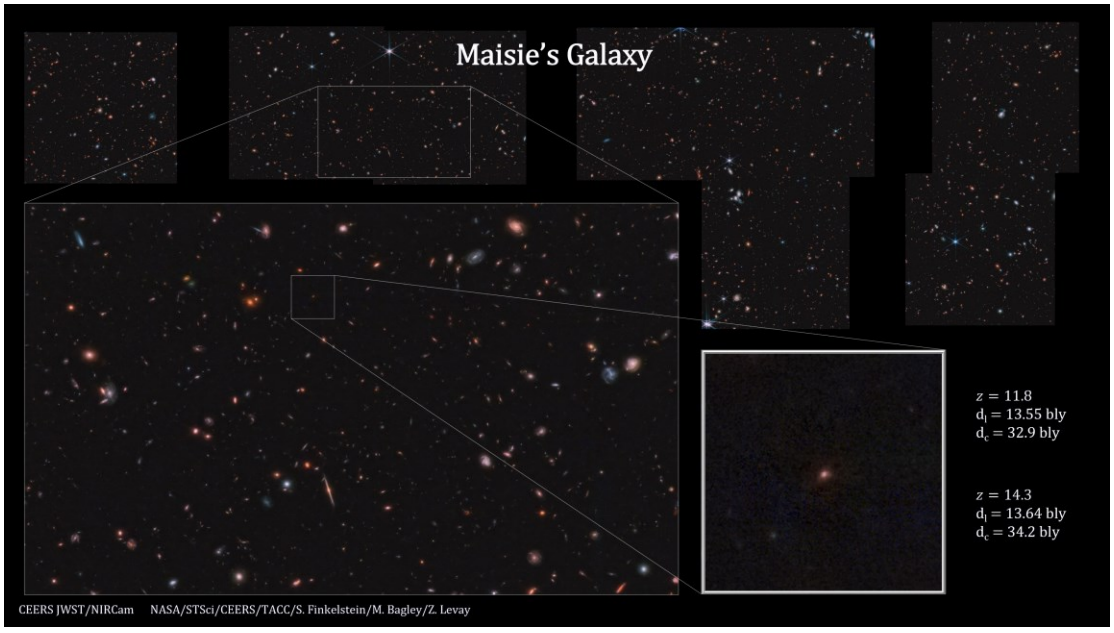
Here, in the same panel, we have an interacting system of galaxies. The CEERS team dubbed it the "Space Kraken". It's redshift is z = 1.4. The light travel 9.35 bly and the galaxies are now 14.1 bly away.



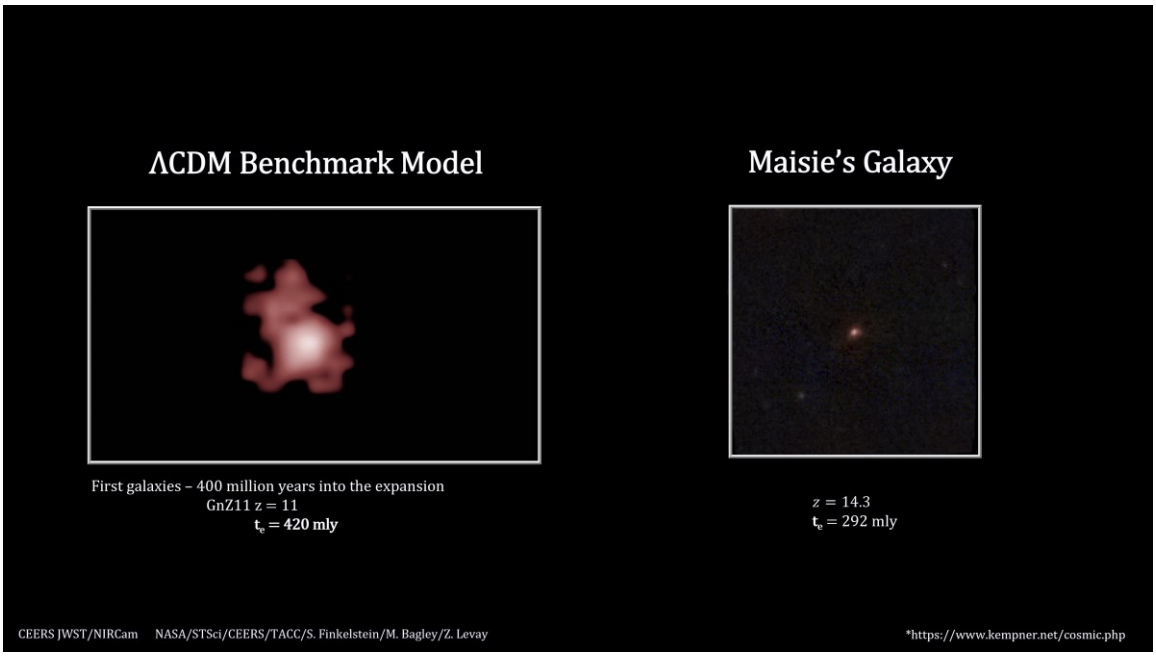
Here's a chance alignment of galaxy with a tidal tail at z = 0.63, 7.8 bly away, and a grouping of red galaxies at z = 1.85. The light traveled 8.5 bly and its current distance is now 16.7 bly. It is currently receding faster than the speed of light and beyond the visible horizon.



Searching for the oldest galaxies, the CEERS team looks for redshifts greater than 12. In one of the large panels, they may have found one. The team named this object Maisie's galaxy. It might be one of the earliest galaxies ever observed with a redshift between 11.8 and 14.3. But, due to a shortage of Webb telescope time needed to do a spectroscopic analysis to directly measure the light's shift to the red, a photometric technique was used instead. The technique uses brightness readings across various standard filters. The more precise spectroscopic data from Webb should be available soon.



If Webb confirmations the high end of this range, the object will challenge the current big-bang theory's timeline. The theory has full blown star forming galaxies appearing around 400 million years after the Big Bang. But Maisie's Galaxy appears to be a fairly high mass and highly star-forming galaxy over a hundred million years earlier than that. It could turn out that the James Webb Space Telescope will change our understanding of the Universe in just its first month of scientific operations. We'll stay tuned.



Credits

JWST/CEERS First Images
https://ceers.github.io/ceers-first-images-release?fbclid=IwAR1Kthqb6gq_eQrxuzFv3uCW3hzw_UeYUezrgZ2oRwL6BTLPtWksUcNeHx4

CEERS Presentation
https://cor.gsfc.nasa.gov/copag/AAS_Jan2021/presentations/CEERS.pdf

First Glimpse at Cosmic Dawn with JWST CEERS whitepaper
https://arxiv.org/pdf/2207.12474.pdf

Convert z to distances and light travel time.
https://www.kempner.net/cosmic.php