Our Sun came late to the Milky Way's star-birth party

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This illustration depicts a view of the night sky from a hypothetical planet within the youthful Milky Way galaxy 10 billion years ago. The heavens are ablaze with a firestorm of star birth. Glowing pink clouds of hydrogen gas harbor countless newborn stars, and the bluish-white hue of young star clusters litter the landscape. The star-birth rate is 30 times higher than it is in the Milky Way today. Our Sun, however, is not among these fledgling stars. The Sun will not be born for another 5 billion years. Credit: NASA, ESA, and Z. Levay (STScI)

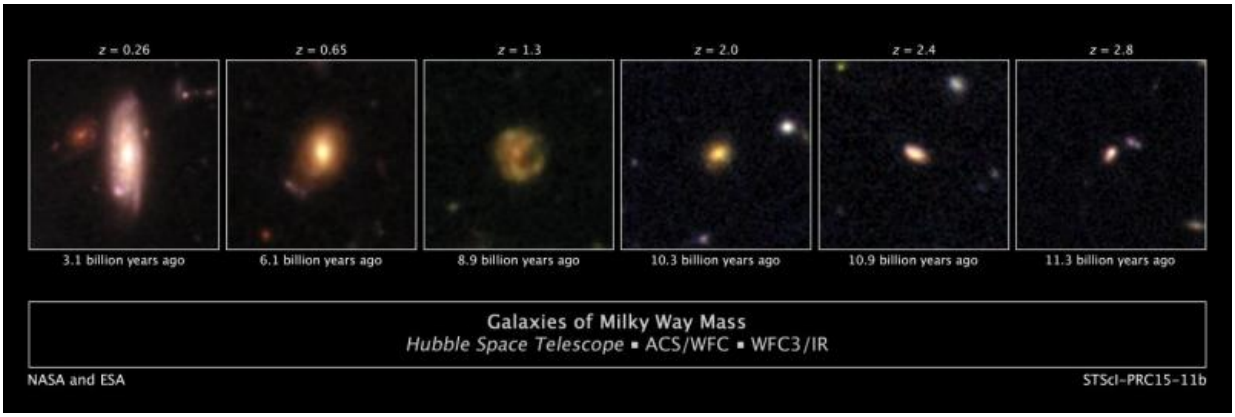
In one of the most comprehensive multi-observatory galaxy surveys yet, astronomers find that galaxies like our Milky Way underwent a stellar "baby boom," churning out stars at a prodigious rate, about 30 times faster than today.

Our Sun, however, is a late "boomer." The Milky Way's star-birthing frenzy peaked 10 billion years ago, but our Sun was late for the party, not forming until roughly 5 billion years ago. By that time the star formation rate in our galaxy had plunged to a trickle.

Missing the party, however, may not have been so bad. The Sun's late appearance may actually have fostered the growth of our solar system's planets. Elements heavier than hydrogen and helium were more abundant later in the star-forming boom as more massive stars ended their lives early and enriched the galaxy with material that served as the building blocks of planets and even life on Earth.

Astronomers don't have baby pictures of our Milky Way's formative years to trace the history of stellar growth. Instead, they compiled the story from studying galaxies similar in mass to our Milky Way, found in deep surveys of the universe. The farther into the universe astronomers look, the further back in time they are seeing, because starlight from long ago is just arriving at Earth now. From those surveys, stretching back in time more than 10 billion years, researchers assembled an album of images containing nearly 2,000 snapshots of Milky Way-like galaxies.

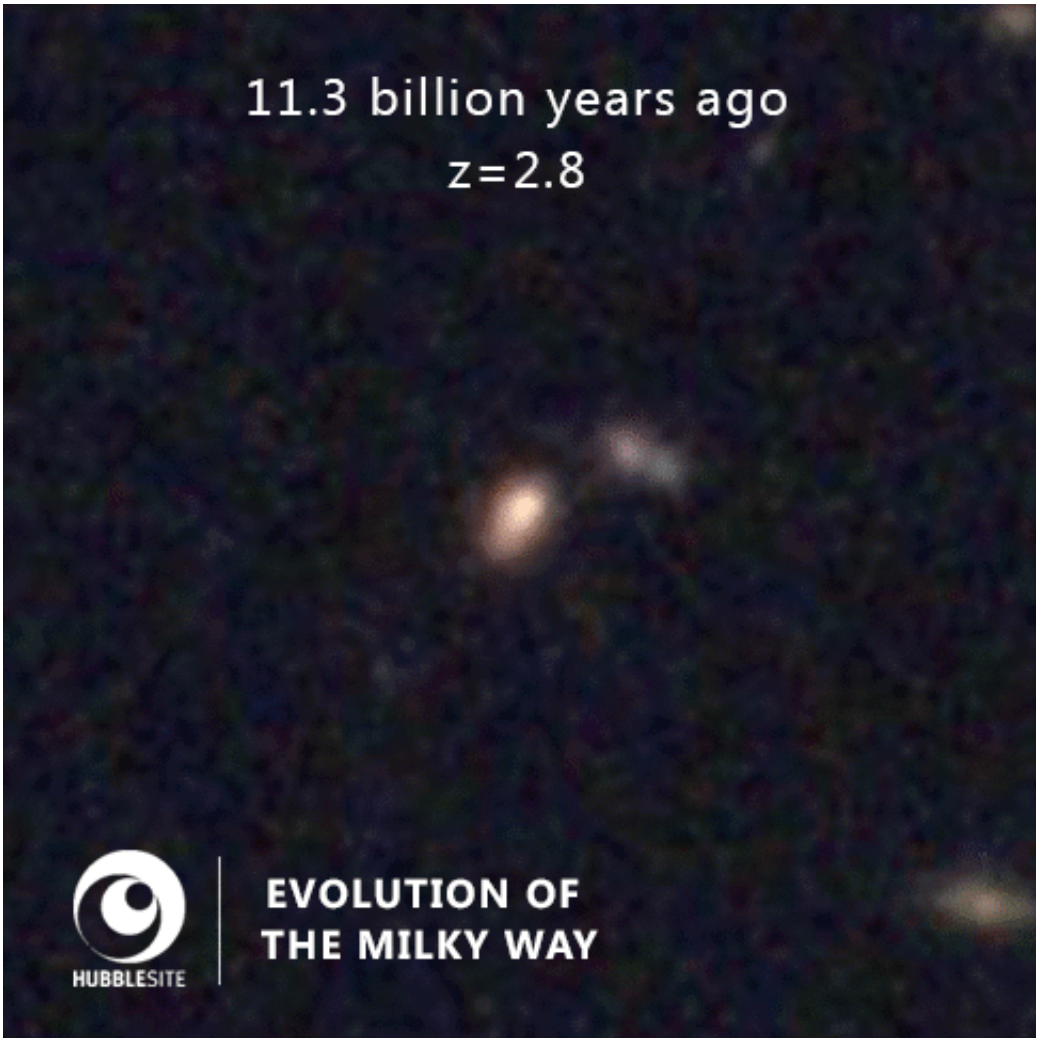
The new census provides the most complete picture yet of how galaxies like the Milky Way grew over the past 10 billion years into today's majestic spiral galaxies. The multi-wavelength study spans ultraviolet to far-infrared light, combining observations from NASA's Hubble and Spitzer space telescopes, the European Space Agency's Herschel Space Observatory, and ground-based telescopes, including the Magellan Baada Telescope at the Las Campanas Observatory in Chile.



This composite of Hubble Space Telescope images illustrates the evolution of Milky Way-like galaxies, as detailed in the most comprehensive, multi-observatory galaxy survey to date, led by Texas A&M University astronomer Casey Papovich. The six chronological images (beginning at far right) reveal that these galaxies -- each similar in mass to our Milky Way -- grow larger and rounder over time. As their stellar population ages, their colors change from blue to yellow to red as their collection of stars burns out in order of brightness. The images were taken between 2010 and 2012 with Hubble's Wide Field Camera 3 and Advanced Camera for Surveys as part of the Cosmic Assembly Near-infrared Deep Extragalactic Legacy Survey (CANDELS). Credit: NASA, ESA, C. Papovich / Texas A&M University, H. Ferguson / STScI, S. Faber / University of California, Santa Cruz and I. Labbe / Leiden University

"This study allows us to see what the Milky Way may have looked like in the past," said Casey Papovich of Texas A&M University in College Station, lead author on the paper that describes the study's results. "It shows that these galaxies underwent a big change in the mass of its stars over the past 10 billion years, bulking up by a factor of 10, which confirms theories about their growth. And most of that stellar-mass growth happened within the first 5 billion years of their birth."

The new analysis reinforces earlier research that showed Milky Way-like galaxies began as small clumps of stars. The diminutive galaxies built themselves up by swallowing large amounts of gas that ignited a firestorm of star birth.



An animated version of the Milky Way Galaxy's life story.

The study reveals a strong correlation between the galaxies' star formation and their growth in stellar mass. Observations revealed that as

the star-making factories slowed down, the galaxies' growth decreased as well. "I think the evidence suggests that we can account for the majority of the buildup of a galaxy like our Milky Way through its star formation," Papovich said. "When we calculate the star-formation rate of a Milky Way galaxy and add up all the stars it would have produced, it is pretty consistent with the mass growth we expected. To me, that means we're able to understand the growth of the 'average' galaxy with the mass of a Milky Way galaxy."

The team's results will appear in the April 9 issue of The *Astrophysical Journal*.

More information: "ZFOURGE/CANDELS: On the Evolution of M* Galaxy Progenitors from z=3 to 0.5," Casey Papovich et al., *Astrophysical Journal*, 2015 April 9: iopscience.iop.org/0004-637X/803/1/26/article , On *Arxiv*: arxiv.org/abs/1412.3806

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