

Opinion | The Webb Space Telescope is telling humanity the history of everything



By George F. Will
Columnist | [+ Follow](#)

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Released by NASA on July 12, 2022, this image from the James Webb Space Telescope shows the edge of a nearby, young, star-forming region, NGC 3324, in the Carina Nebula.. (NASA, ESA, CSA, and STScI via AP)

BALTIMORE — At the Space Telescope Science Institute, on the Johns Hopkins University campus, a constant torrent of data pours in from NASA's James Webb Space Telescope, enabling cosmologists to write ancient history. Not the history of the Greeks and Romans, who lived a mere blink ago. Rather, it is the history of *everything*.

Everything began, cosmologists currently think, with a bang — the Big Bang; if *it* does not deserve to be a proper noun, what does? — 13.7 billion years ago. All the material in the universe, including us, is — literally — stardust (cue Nat King Cole's rendition), meaning residues of the explosion. The light gathered by Webb's mirrors expands our knowledge of how stars form. And perish: This is not going to end well.

Launched 13 months ago, Webb is orbiting 940,000 miles away. With its 18 mirrors and its five sunshield layers unfolded, it is a tennis-court-size

engineering masterpiece. To function, each mirror must, after being hurled into space on a shuddering rocket, retain this exquisite precision: If each mirror were the size of the continental United States, each should not vary more than 2 inches from perfect conformity with the others.

Furthermore, the mirrors left Earth the “wrong” size: They were designed to contract in space to achieve a precise shape at the temperature out there: minus-388 degrees Fahrenheit.

The wavelength of light is “stretched” as the universe expands; hence the analysis of light can date the light’s source. Above the filter of the Earth’s atmosphere, Webb has already gathered light that has taken more than 13.4 billion years to reach its mirrors, light from the earliest galaxy yet confirmed: It formed only 350 million years after the Big Bang.

The U.S. lunar expeditions, the last of which was in 1972, were feats of individual bravery and engineering ingenuity. They were, however, without the scientific fascination that has driven space exploration since the discovery in 1965 that the universe is permeated with background radiation. This seems to confirm the Big Bang theory.

Scientific propositions are, however, testable and hence theoretically falsifiable, so even familiar ones are contingent. The Big Bang theory postulates that the universe was inflated from a microscopic speck in a trillionth of a trillionth of a second, at a temperature of trillions degrees centigrade. And is still expanding.

Sergio Peçanha: Stop for a minute. These space images are worth your time.

If so, Copernicus’s supposed impertinence — demoting Earth (and us) from the center of the universe — was, we now know, nonsensical: There is no center in an expanding universe without an edge.

Astronomer Adam Frank says Webb, which was expected to support the Big Bang theory, has revealed “the existence of galaxies so old that the very origins of the universe have instead been called into question.” As has, some say, the theory of an expanding universe. Not so, says Frank:

For most of the previous 2,500 years, the universe was considered timeless and unchanging. Even by Albert Einstein, who, Frank says, “assumed that the universe now must look like the universe a trillion years in the past and

future.” By proving that galaxies formed before they had previously been expected to exist — “just a few hundred million years after the cosmic expansion began” — Webb has done what, Frank says, science should do, which is “force us to confront false assumptions we hadn’t even known we’d made.” Doing so, he says, the telescope has confirmed the essence of the Big Bang theory: “cosmic evolution.” The universe has a history. As we learn how to write it, we learn about our place in it.

Earth is “biophilic” — conducive to life — only because the Big Bang led to molecules of water and atoms of carbon, which are necessary for life. They need not, however, have been included in a post-Bang universe. For some theologically inclined people, this fact means that we are not a cosmic fluke but a cosmic imperative.

Our sun, however, will expire in approximately 5 billion years. About when our wee Milky Way galaxy with its 200 billion stars will collide with the nearby Andromeda galaxy. The universe, as portrayed by the light that Webb gathers, is breathtakingly beautiful and unimaginably violent.

Earth is biophilic only somewhat (volcanoes, earthquakes, viruses, etc.), and only briefly, as measured by the cosmos’s clock. But what distinguishes us from trees and trout and every known (so far) thing in the universe is what Webb exists solely to satisfy. The Webb Space Telescope speaks well of us precisely because it has, and needs, no justification beyond the purity of its service to curiosity.

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