

Why the James Webb Telescope is NASA's most ambitious space probe to date

December 17 2021, by Juan Siliezar



Full-scale model at South by Southwest in Austin. Credit: NASA/Chris Gunn

NASA is set for another Apollo moment with the launch of its new James Webb Space Telescope as early as Dec. 24, barring complications. Billed as NASA's most ambitious telescope to date, its purpose is to fundamentally alter our understanding of the universe.

Light takes time to travel. The nearest star to Earth is four light-years

away, so the image we see of it is actually four years old. The new \$10 billion instrument is so powerful it will allow us to see farther, essentially to look back in time to see how the [first stars](#) and galaxies came into existence. It will also let us peer into the atmospheres of exoplanets—some of which are potentially habitable—as they pass before stars. The light filtering through the atmosphere will leave telltale signs of the atmospheric components.

Mercedes López-Morales, a lecturer in the Department of Astronomy and an astrophysicist at the Center for Astrophysics | Harvard & Smithsonian, will be among the first researchers to use the Webb as part of a project to observe more than a dozen [small planets](#) during the [telescope's](#) first cycle. The Gazette spoke to López-Morales about the new telescope, which was named after the former NASA administrator who led the agency through the Apollo missions, and why it has the scientific community so excited. The interview has been edited for clarity and length.

Q&A: Mercedes López-Morales

GAZETTE: Can you talk about the mission of the Webb telescope?

LÓPEZ-MORALES: The James Webb Telescope is the most important flagship space mission ever built. It's considered the successor of the Hubble Space Telescope, which was launched more than 30 years ago and completely changed the way we understand how the universe works at ultraviolet, visible, and near-[infrared wavelengths](#). Unlike visible light, ultraviolet and infrared light are hidden from the human eye, and we need special detectors to see them. They hold the secrets of primordial galaxies and the chemical composition of outer space, as well as nearby planets. The capabilities of the James Webb will take us beyond what we

learned with Hubble by further opening our eyes to the infrared universe. We'll be able to study how the universe looked at the beginning and determine when the first galaxies and stars formed. We will also be able to study how and where in our galaxy stars and planets are forming right now, and, for the first time, to study what the atmospheres of exoplanets are made of and how similar or different the atmospheres of exoplanets are from the atmospheres of planets in our own solar system.

GAZETTE: What makes the Webb the most ambitious space probe NASA's ever built?

LÓPEZ-MORALES: A number of things. NASA has been building this telescope for 25 years. It's hard to tell, but just as a ballpark, I would say thousands of scientists and engineers have worked on it. Maybe the biggest reason is that there are many technological advancements that are being used for the first time on a space telescope.

GAZETTE: What are some of those?

LÓPEZ-MORALES: One of the most spectacular is the [primary mirror](#) that is 6.5-meters in diameter [more than 21 feet], making it the largest telescope mirror ever launched into space. To make it possible to fit such a large mirror into the [launch vehicle](#), engineers had to figure out a completely new way to build mirrors. They split them into a number of hexagonal pieces, each one with its own specific shape so that they could be folded for launch and then once in space they unfold and latch together like pieces of a puzzle into this massive and beautiful mirror painted with a very thin layer of gold with basically no gaps between the pieces.

GAZETTE: The mirror is a very crucial piece of this telescope?

LÓPEZ-MORALES: I always tell people that the mirror is like a bucket. The bigger the bucket, the more data you can collect. That translates into you seeing and collecting more light—both visible and the not-so-visible. Basically, you can push farther into the universe and further back in time.

GAZETTE: What else amazes you about the telescope?

LÓPEZ-MORALES: I would say the sunshield. There are two key requirements for the telescope to be able to produce high-quality observations. It has to be kept cold, at a stable temperature of about minus 200 degrees Celsius [minus 328 degrees Fahrenheit], and it has to be prevented from getting blinded by sunlight. The sunshield takes care of those requirements by shielding the telescope from the sun's light and heat.

It's a technological masterpiece. It's made out of five very thin layers coated with aluminum, so they reflect the light from the sun. Each layer is like a sail. At launch, the sunshield is folded in, in a similar way as the telescope's mirror is, and once in space the sunshield unfolds to a size of about a tennis court.

GAZETTE: Can you talk about your work with the telescope so far, and what's upcoming?

LÓPEZ-MORALES: One of my main research interests is understanding the atmospheres of exoplanets, which are planets we have been discovering orbiting around nearby stars for more than two decades now. We have discovered a few thousand exoplanets now, and with that number we can, for the first time, start looking into answering a number of questions that weren't possible to answer before. I am part of teams

that will for the first time search the atmospheres of a number of exoplanets in the infrared to search for molecular species such as methane, ammonia, and carbon, magnesium, and silicate compounds. We cannot detect these with current telescopes, including Hubble. The presence or absence of such chemical species will tell if the planets have atmospheres at all, and if they do, what they are made of and how they compare to the make-up of similar planets in the solar system.

GAZETTE: What's your biggest hope for this telescope?

LÓPEZ-MORALES: I hope that it helps us discover things that we had not thought about since that is how many of the major breakthroughs in science happen. You open a new window and discover that there is a lot of new information there that we had not considered. I also hope that the discoveries will inspire younger generations in the same way that the Hubble images inspired many of us who are now scientists and engineers.

This story is published courtesy of the [Harvard Gazette](#), Harvard University's official newspaper. For additional university news, visit [Harvard.edu](#).

Provided by Harvard University

Citation: Why the James Webb Telescope is NASA's most ambitious space probe to date (2021, December 17) retrieved 24 April 2024 from <https://phys.org/news/2021-12-james-webb-telescope-nasa-ambitious.html>

<p>This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.</p>
--