Times-Standard
Times-Standard / Humboldt Beacon

Not My Fault: The James Webb Space Telescope provides a moment of awe

Lori Dengler/For the Times-Standard
Posted July 16, 2022
https://www.times-standard.com/2022/07/16/lori-dengler-james-webb-telescope-provides-moment-of-awe/

I have been in a state of anticipation since the launch of the James Webb Space Telescope (JWST) last December. This week the JWST delivered its first official photographs, a suite of images chronicling the life of stars from birth to death and the deepest glimpse yet into the universe.

The five images released provide a taste of what is to come. The first image was billed as Webb's first deep field. It shows a speck of the sky about the size of a grain of sand held at arm's length, what we would see as just empty from earth. From the JWST's infrared eye, it's not empty at all. Galaxies cram the frame, some bent and distorted by gravity. The nearer galaxies in the image mark a moment in time about 4.6 billion years ago, just before our own solar system began to form; the more distant ones are more than twice as old only a billion or so years after the birth of the universe.

Two of the images mark the birth and death of stars. The Carina Nebula in our own Milky Way has been known to astronomers for over 250 years. The first Carina images from the Hubble Space Telescope were released 12 years ago and made the pages of newspapers all over the world. JWST's image reveals even more complexity, penetrating the gas and dust to show textures in the nebula never before see and even revealing jets of gas blowing out from brand new stars.

A third image shows the Southern Ring Nebula, a relatively near neighbor in the constellation Vela, a mere 2,500 light years away. A star at the center has been in the throes of dying for thousands of years, sending out rings of dust and gas. Spectrometers on the JWST will allow for detailed analysis of the rings. And like all of the JWST images, the background which had previously seemed empty, is chock full of many more galaxies.

For me, the most beautiful of the JWST photos is Stephan's Quintet, a grouping of five galaxies in collision. At first glance looking like luminescent sea creatures, it captures the largest field of view – equivalent to a fifth of the moon's diameter- and showing shock waves triggered by the gravitational interactions. It will shed light on the dynamics of black holes as galaxies collide.

The last of the quintet of images is a graph showing the JWST's spectrographic chops and an aspect to research areas that were unknown when the telescope was proposed more than twenty years ago. The first confirmed exoplanet (outside our own solar system) was discovered around the same time and so JWST pulled a team together to focus on planets that might foster life. The WASP-96 b image is a graph of water content in the atmosphere of a planet as it orbits a sun-like star about 1000 light years away from us. As the planet orbits, gravity deforms the atmosphere and the light traveling through it from the star captures the cyclic variation.

I am not an astrophysicist, and this is all as new to me as it is to most of you. But I do know something about scientific "aha moments". It is the moment when you see something completely new for the first time and it fills you with a sense of wonder, joy, and awe. It is the reason why I became a scientist.

I've been glued to podcasts, videos, and reports from the JWST mission since it launched. I have marveled at the care taken over every aspect and how each of the more than 300 possible points of critical failure were overcome (NOVA https://www.pbs.org/video/ultimate-space-telescope-gunryt/). I have been just as struck by the elation on the faces and the words of team scientists and other astrophysicists as they marvel over the early results.

Our education system doesn't do a very good job of conveying the essence of science. From elementary through high school, most of us are given piles of facts to memorize and problems to slog through, all of which have been solved by generations of students before us. I had no intention of becoming a scientist after high school because it seemed dull, everything of importance has already been discovered, and only geniuses could contribute anything new. Fortunately, the required science course I took as a sophomore in college was taught by a brilliant man who showed me that it is something very different.

At its core, science is solving puzzles and the puzzles real and are all around us. The most important skills of scientist are curiosity, being able to ask questions, gathering information and being able to look at it in new ways. You can see the excitement in the interviews with the JWST scientists young and old. They have all been give the best of presents that will likely guide the rest of their careers –

reams of beautiful new data in every direction the telescope is pointed.

My own aha moments have been far more private, and on a far smaller scale, but no less thrilling to me. As a graduate student, struggling to find a PhD topic, I remember meeting a fellow parent at the campus childcare center my two-year old attended. He was an electrical engineering grad and was working on the early Scanning Electron Microscopes. I was curious and asked if I could look at rock samples in it and he said sure. For the next three years I spent hours in a small dark cubical pouring over rocks. I was looking at a whole new world that no one had ever seen before. Much of my time was spent just learning to see and quantify my observations. It was all new and there were no rules.

I had a similar aha moment in May when the first images from the Humboldt optical fiber experiment were shared with our project team. At first it took a little while to comprehend what I was seeing and then it slowly came into focus, the station array, the different seismic waves, even cars driving on the road. Like the JWST, it will take time to pull out all the information our new glimpse of the world has given us. And like the JWST team, our small group is just as excited about what we will learn next.

Note: Nasa has detailed information on the first five images at https://www.nasa.gov/webbfirstimages. A summary of the early results and scientific performance of the JWST is at https://arxiv.org/abs/2207.05632. Listen to Neil deGrasse Tyson unpack what has been learned so far https://www.youtube.com/watch?v=avAMY6Kt6Nc, and follow #NASAwebb on twitter for the latest breaking releases.

Lori Dengler is an emeritus professor of geology at Cal Poly Humboldt and an expert in tsunami and earthquake hazards. The opinions expressed are hers and not the Times-Standard's. All Not My Fault columns are archived online at https://kamome.humboldt.edu/resources and may be reused for educational purposes. Leave a message at (707) 826-6019 or email rctwg@humboldt.edu for questions and comments about this column, or to request a free copy of the North Coast preparedness magazine "Living on Shaky Ground."