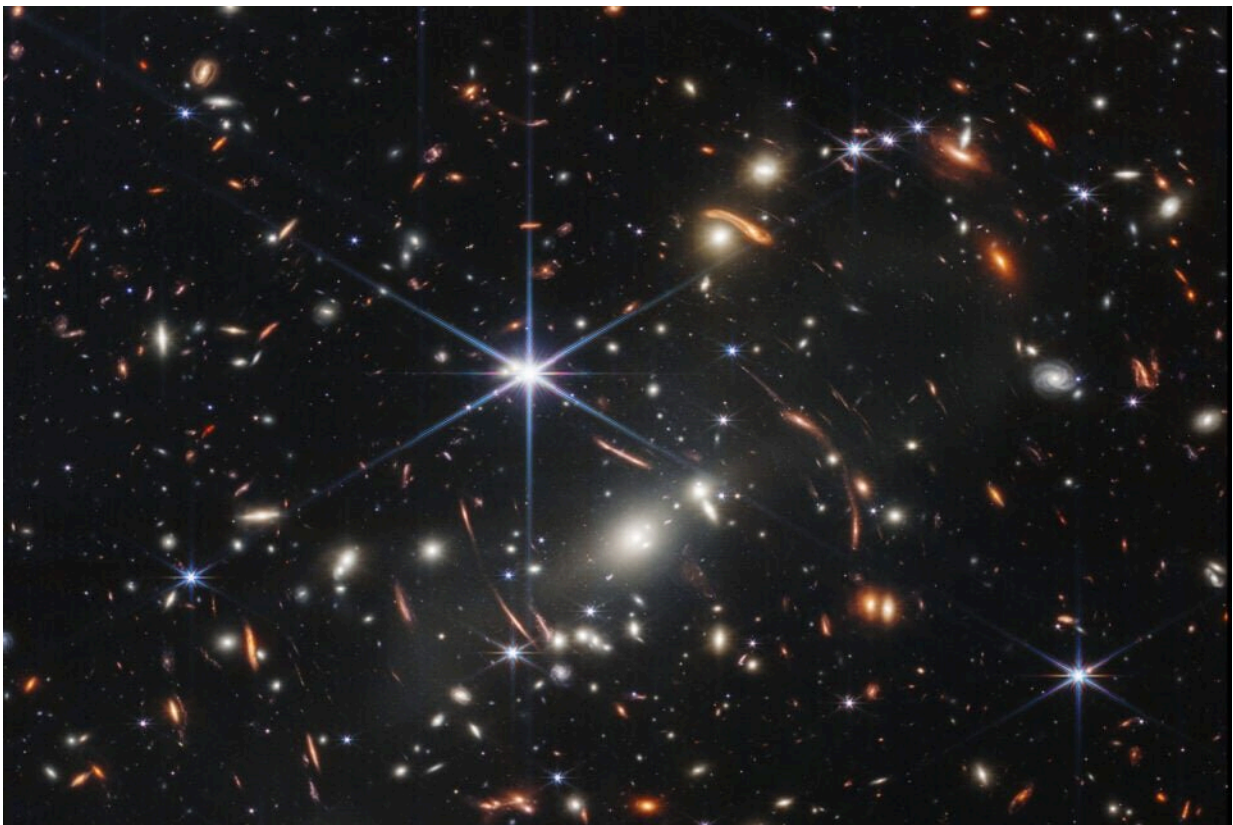


A cosmologist, cultural historian, and neurosurgeon discuss the power of awe and the cosmos

September 6 2022, by Melissa de Witte



NASA described Webb's First Deep Field, galaxy cluster SMACS 0723, as "approximately the size of a grain of sand held at arm's length, a tiny sliver of the vast universe." Credit: NASA, ESA, CSA, STScI

The images to emerge from the James Webb Space Telescope have captured details of the cosmos never seen before, leaving the scientific community and public alike in a state of awe. In a Tweet, former President Barack Obama described them as "mind-blowing." Even Stanford cosmologist Zeeshan Ahmed, for whom such images are commonplace, admitted: "You can't contain it in your head. I think this is true for everybody—I mean, scientists are human still."

"Awe is sort of this ineffable sense of transcendence," said Stanford neurosurgeon and compassion scholar James Doty. "In some ways, you melt into it."

Scholars across disciplines have long sought to understand the stirring—soul searching, even—emotions the universe evokes. Some have described a shakiness they call "cosmic vertigo." Others have used the term "cosmic insignificance" when confronted with one's littleness in a limitless universe. A few have found dwelling too long on such thoughts to be anxiety-inducing, an experience they label "neuroexistentialism."

To describe how images from [outer space](#) can excite and expand the [human mind](#), Stanford advanced lecturer in American studies Elizabeth Kessler, who studies the visual culture of astronomy, has found it useful to draw on the sublime, an aesthetic concept that the eighteenth-century philosopher Immanuel Kant associated with natural phenomena of vast size, scale, or power, such soaring mountains, deep abysses, plunging waterfalls, and the star-filled sky in trying to understand the emotions evoked in himself by the Milky Way and the starry heavens. For Kant, the experience of such immensity overwhelmed the senses, but human reason could transcend those limits, which made it an affirming experience that expanded knowledge and understanding.

Bigger and beyond

A casual stroll across the university campus is enough to reveal the extent to which the universe can serve as a muse.

At Stanford, representations of outer space can be found beyond the research labs and classrooms of astrophysicists and cosmologists. Walk across the Engineering Quad Courtyard and one will encounter Alicja Kwade's installation, *Pars pro Toto*, 12 human-sized stone planetary orbs that combine the geological with the cosmological to inspire new ways of thinking about the world. At the Cantor Arts Center, a cast of Auguste Rodin's iconic thinker shines under the fluorescent glow of Spencer Finch's representation of the exploding Betelgeuse star. Wrapping the staircase to the David Rumsey Map Center at Green Library are reproductions of 17th-century star and constellation maps, beautifully blown up to emphasize figures from Greek mythology amid celestial heavens—all reminders of humanity's place in the world and our connections to each other.

For Doty, who is also the founder and director of the Stanford Center for Compassion and Altruism Research and Education, of which His Holiness the Dalai Lama is the founding benefactor, awe's power lies in its ability to make us feel connected to something much larger than ourselves.

"At the end of the day, we are all one, not only with each other but with every living being and in fact, with the universe," Doty said. "The very nature of thinking about that, and understanding you are the part of this extraordinary thing that is going on around us, creates this deep sense of purpose and connection, and in some ways, happiness."

The transcendent experience of self-realization and oneness is also the basis of many religions, Doty points out. For example in Buddhism, there is a deep desire to attain enlightenment, which ultimately is about merging oneself with the universe.

Designed to inspire

According to Kessler, the art historian, who has examined the parallels between art and philosophy and [astronomical images](#) in her book, "[Picturing the Cosmos: Hubble Space Telescope Images and the Astronomical Sublime](#)" (University of Minnesota Press, 2012), astronomical images are crafted in a way to represent scientific data and evoke an aesthetic response.

As Kessler learned in her interviews with the team that produced images for the Hubble Heritage Project, NASA wanted to circulate imagery that would inspire the general public, not just individuals working in science and technology. Like any representation, every astronomical image involves decisions about how to depict celestial phenomena captured by the telescope in a way that won't feel strange to audiences.

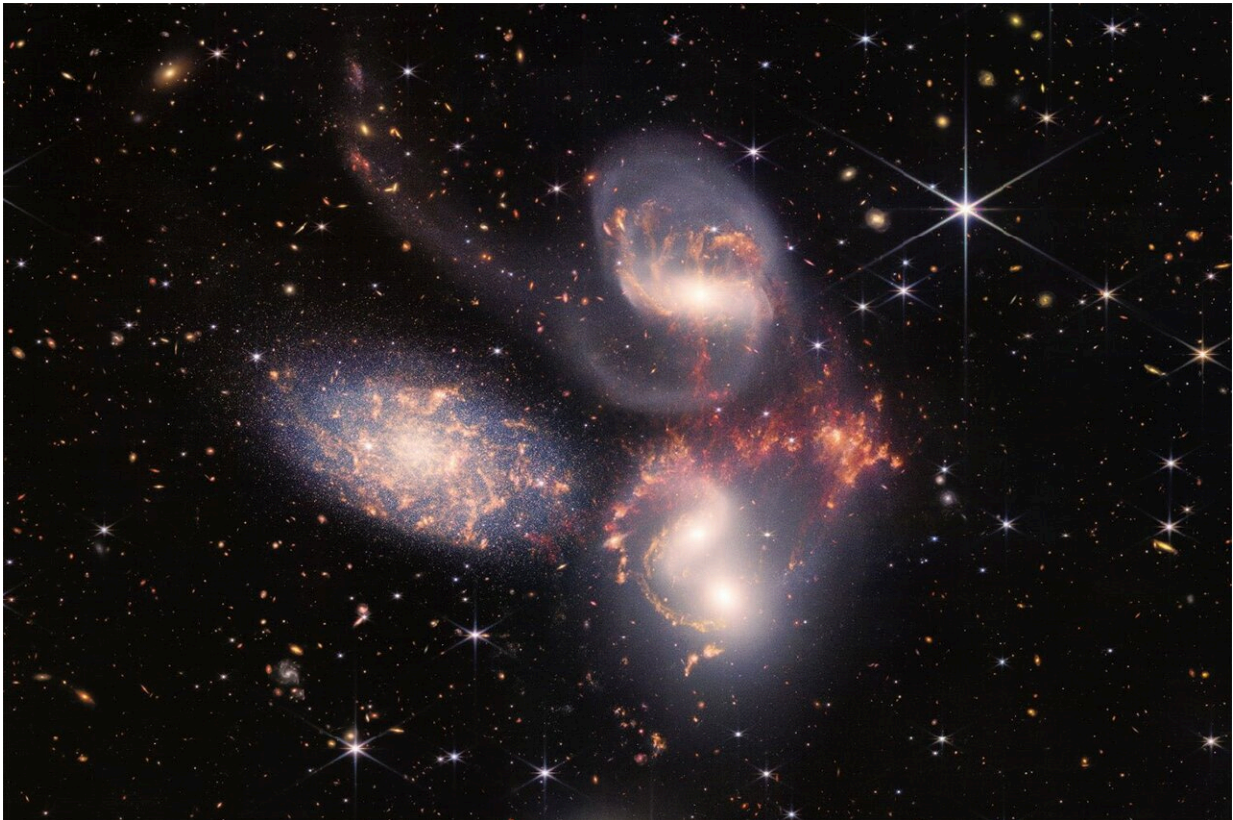
"Astronomers and image processors carefully balance the need for a scientifically valid image with the desire for an aesthetically compelling one," said Kessler.

Because telescopes collect data too faint for our eyes to see and beyond the [visible light spectrum](#) (JWST primarily in infrared light, Hubble in visible and ultraviolet), their images are assigned colors in order for us to appreciate them more fully. Every color picture from JWST, for example, is actually a composite of at least three different monochrome images, each one collected using a filter that captures a different wavelength of [infrared light](#). Exposures can last hours or even days. Each filter is then assigned a different color, which is combined into the final images that get circulated.

While any color can be mapped onto any wavelength, astronomers believe some color combinations work better than others. For example, in the Hubble Heritage Project's early rendition of the planetary nebula

NGC 3132, the team experimented with an unconventional color scheme of pinks and yellows. But the end result "didn't feel right," said astronomer Keith Noll in an interview with Kessler, so they used colors less strange and more typical of terrestrial worlds.

Because the development of astronomical images involves many such artistic choices, Kessler likens the process to 19th-century landscape paintings and photographs of the American West, where light, shadows, and colors were used in ways to conjure the sublime that Kant wrote so prolifically about.



NASA's James Webb Space Telescope has been able to show new, finer details of the galaxy group, Stephan's Quintet. The rendering here was created from nearly 1,000 separate image files. Credit: NASA, ESA, CSA, STScI

The composition of astronomy images is another artistic choice. In outer space, cardinal directions don't matter. So, one exercise Kessler does with her Stanford students is to flip images like the Eagle Nebula —also called "Pillars of Creation"—upside down. When inverted, it becomes a large, amorphous shape.

"Instead of grand pillars that inspire awe as they loom above in the sky, they ooze off the page and look sort of monstrous and gruesome; there is nothing evocative about them," Kessler said.

Understanding the incomprehensible

Considering how one light year—the distance that light can cover in a year—is equivalent to 6 trillion miles and astronomers are observing stars billions of years from earth, the vastness is almost incomprehensible. Nevertheless, it is calculable. NASA has tried to quantify it in a variety of ways; recently, they described Webb's First Deep Field—which is 4.6 billion light years away—as "approximately the size of a grain of sand held at arm's length, a tiny sliver of the vast universe."

Cosmic figures—whether it is the distance from Earth or the number of stars in the universe—are "unfathomable," said Ahmed, a lead scientist at SLAC National Accelerator Laboratory and a senior member at Kavli Institute for Particle Astrophysics and Cosmology who studies the cosmic microwave background, which is the afterglow of the big bang. He described how early in his career, his perception of the universe evolved to be more of a mathematical problem to solve, rather than a philosophical one.

Ahmed has been reading with his four-year-old preschooler the children's book, a Hundred Billion Trillion Stars, which puts numbers into scale. "It was funny going through that book because it's all about

introducing young children to large quantities and numbers, like seven billion human beings weigh about as much as 10 quadrillion ants," he said.

Before reading the book, Ahmed said his son thought 100, an amount he could conceptualize, was a large number. Now, a billion is big. Ahmed remembers feeling that same child-like astonishment when he first saw the Hubble images. "The thing that blew my mind was realizing that every object in the first Hubble Deep Field pictures was not a star—it was a galaxy," Ahmed said.

For the neurosurgeon Doty, the power of awe works in both directions. Just as the vastness of the universe can stir curiosity, so can the infinitesimal. For example, contemplating the number of atoms in the universe can "make you wonder how all of this is possible," he said. (Fascination with the molecular minutiae is the subject of the August issue of Stanford Medicine magazine.)

For some, there is a certain amount of terror in the unknown, both Doty and Kessler acknowledged. The philosopher Edmund Burke, for example, found the ideas of infinity and eternity exciting and terrifying.

To decrease that anxiety and fear, the mind establishes a narrative, Doty said. "Trying to explain the unexplainable gives you comfort," he said.

Kessler argues that in many ways, astronomical images that evoke the sublime are another way to calm and contain those fears.

"You're not asked to get lost in the infinite but to reflect on the vastness of the universe and our place within it," she said. "These images might remind us of our relative insignificance, but also our potential to come to know and understand what lies beyond us and our world."

'A collaboration between humans and technology'

Kessler thinks the criticisms that NASA's images are manipulative for depicting celestial phenomena the human eye could never see are misguided; astronomers and image processors carefully craft the images to ensure they are scientifically valid (Ahmed, the cosmologist, likened their resolution and magnification to him wearing glasses that help him see the world more clearly).

As Kessler emphasized, "this is a kind of vision that's only possible through a collaboration between humans and technology."

Through the blending of art and science, space telescope images allow us to see the universe in new and exciting ways. They are also incredibly humbling, affirming what it means to be alive.

"We arise from stardust and we return to stardust," said Doty. "That cyclical connection and reality that we are all part of whatever exactly 'this is' makes us feel, in some ways, special while also feeling insignificant."

Provided by Stanford University

Citation: A cosmologist, cultural historian, and neurosurgeon discuss the power of awe and the cosmos (2022, September 6) retrieved 23 April 2024 from <https://phys.org/news/2022-09-cosmologist-cultural-historian-neurosurgeon-discuss.html>

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.