

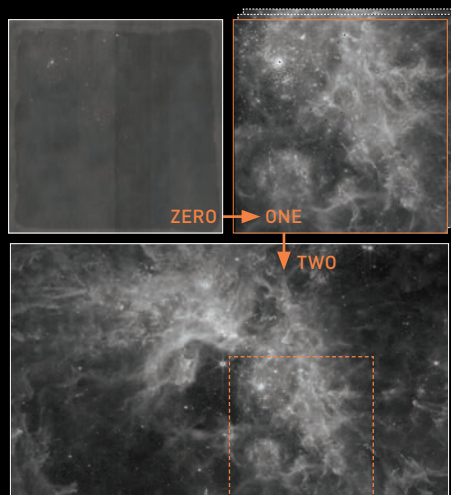
Webb Imagery: Science & Art

The beautiful images from the James Webb Space Telescope (JWST) begin as infrared-light observations beyond what our eyes can detect. Imaging specialists translate the astronomical data into viewable imagery. Here we look at the process for one of JWST's first observations, the Tarantula Nebula (also known as 30 Doradus). For more on the Webb telescope, see this month's cover story (p. 28).

1. SOURCE DATA: Webb's Tarantula Nebula is a multi-image mosaic composed of data from three wideband filters (0.9 μm , 2.0 μm and 4.4 μm) and a continuum subtraction medium-band filter (3.35 μm) from JWST's Near-Infrared Camera (NIRCam) instrument.

2. BUILDING THE BASE

A nonlinear stretch is applied to individual NIRCam exposures to increase the brightness of the darkest pixels while maintaining details in brighter pixels. Artifacts, like oversaturated star cores, are also addressed.



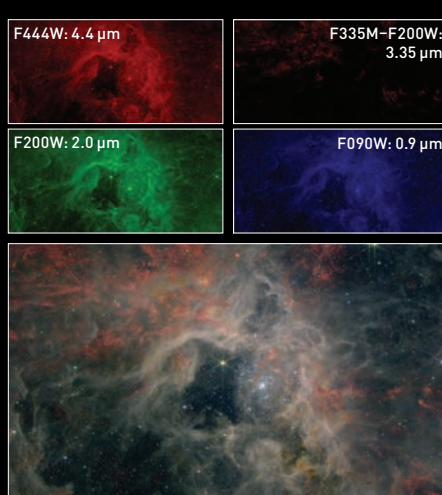
STAGE ZERO: A single uncalibrated exposure, 161 seconds collecting photons of IR light.

STAGE ONE: Eight individual calibrated and stretched exposures combined into one.

STAGE TWO: The stitched-together mosaic of 30 Doradus for a single filter.

3. DEFINING THE COLOR

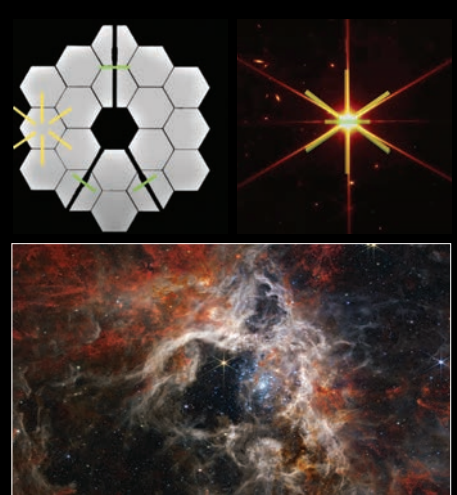
Color is added chromatically, with the shortest wavelengths assigned blue, slightly longer wavelengths green and longest wavelengths red—bringing the visible spectrum to the image.



SEEING THROUGH DUST: Continuum subtraction makes it possible to isolate very specific wavelengths of light. The 3.35- μm filter (upper right) highlights the warm dust made of tiny hydrocarbon rings within 30 Doradus. It is overlaid in a reddish orange in the combined color image (bottom), providing depth.

4. REFINING FOR BEAUTY

Adjustments are made for contrast and color balance, taking care to bring out scientifically significant details. There are also aesthetic decisions, as in the preservation of Webb's star diffraction data.



A UNIQUE SIGNATURE: Webb's six-pointed star diffraction pattern comes from interaction with the hard lines of its hexagonal mirrors and support structure (top). This "twinkling" distortion is in all JWST releases, including in the final 30 Doradus image (bottom)—scientific beauty with a touch of art.

Process your own astronomical image: universe-of-learning.org/resources/projects/nasas-astrophoto-challenges

Sources: A. Pagan and J. DePasquale, The Art & Science of Webb Imagery, youtube.com/watch?v=dJX0RAYuqos / illuminateduniverse.org/webbtelescope.org
Tarantula Nebula images: NASA, ESA, CSA, STScI, Webb ERO Production Team and J. DePasquale / Infographic by Alessia H. Kirkland