Keeping NASA's James Webb Space Telescope in the dark

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Eric Zoller, a technician from Harris Corporation, headquartered in Melbourne, Florida, checks the helium shroud in Chamber A at NASA's Johnson Space Center on July 12, 2017. Credit: NASA/Chris Gunn

This bunny-suited technician is performing the important task of ensuring no unwanted infrared light interferes with the optical testing of

NASA's James Webb Space Telescope inside of Chamber A at NASA's Johnson Space Center in Houston.

Because of the Webb telescope's extreme sensitivity to infrared light, the shroud was made nearly impervious to outside light sources that could contaminate the testing.

"One of the challenges of testing an infrared telescope is that room-temperature objects (such as the walls of the vacuum chamber itself, or the warm electronics systems inside it) glow at the wavelengths of light that the telescope is trying to measure," explained Randy Kimble, a scientist at NASA's Goddard Space Flight Center in Greenbelt, Maryland, who is helping conduct optical testing of the telescope. "If not carefully controlled, that warm glow can provide an unwanted background in the telescope's images, which would compromise the optical testing."

The cold gaseous helium shroud inside Chamber A is the innermost of two shrouds used to cool the Webb telescope down to the temperatures at which it will operate while in orbit. This shroud sits inside an outer liquid nitrogen shroud, and the technician in this photo is standing in the space between them. This photo was taken before all of the air was removed from the chamber and it began to cool to cryogenic temperatures.

The two shrouds are thin, cylindrical, metal shells that work together to lower the temperature of the area in which the telescope sits. They are nested inside the chamber like Russian Matryoshka dolls that sit inside each other. The chamber is the largest "doll," followed by the liquid nitrogen shroud, the cold gaseous helium shroud, and then the smallest "doll"—the Webb telescope. The liquid nitrogen and cold gaseous helium flow through plumbing that crisscrosses the surface of their respective shrouds.

Protecting the shroud doors, which give access to the shrouds' interiors, is particularly important to ensure unwanted infrared light is unable to interfere with the telescope. Kimble said engineers used a layer of black Kapton, a thin, opaque, plastic film ideal for use in a vacuum, to curtain the door into the cold gaseous helium shroud. This Kapton curtain curtails the amount of light that can get into the shroud through the seam around the door.

The mercury-like, reflective material in the photo is an aluminized polyester sheet that was placed over the black Kapton curtain. The liquid-metal look of that covering and the otherworldly, distorted reflection it gives are partially caused by the amount of play the curtain is required to have. "The Kapton material...shrinks a lot as it cools, so we needed to make sure that it was not taped down so tightly that it would tear during cooldown," explained Kimble.

Because of Kimble's work making sure the test environments at both Goddard and Johnson for the Webb telescope and its instruments were dark enough for optical testing, he is affectionately known as the "Prince of Darkness," a moniker in which he takes pride. "I like it," said Kimble. "If the chamber is appropriately dark, then I've done my job."

Despite the royal nickname, Kimble stressed it took a team effort to ensure the telescope was properly insulated from outside infrared light in Chamber A. "Many people have worked for years on the test design and implementation to keep infrared light, from warm sources in the test chamber, from getting into the telescope beam," Kimble explained. "The final visual inspections and blanket closeouts...are just the icing on that well-baked cake."

The James Webb Space Telescope is the scientific complement to NASA's Hubble Space Telescope. It will be the most powerful space telescope ever built. Webb is an international project led by NASA with

its partners, ESA (European Space Agency) and the Canadian Space Agency.

Provided by NASA's Goddard Space Flight Center

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