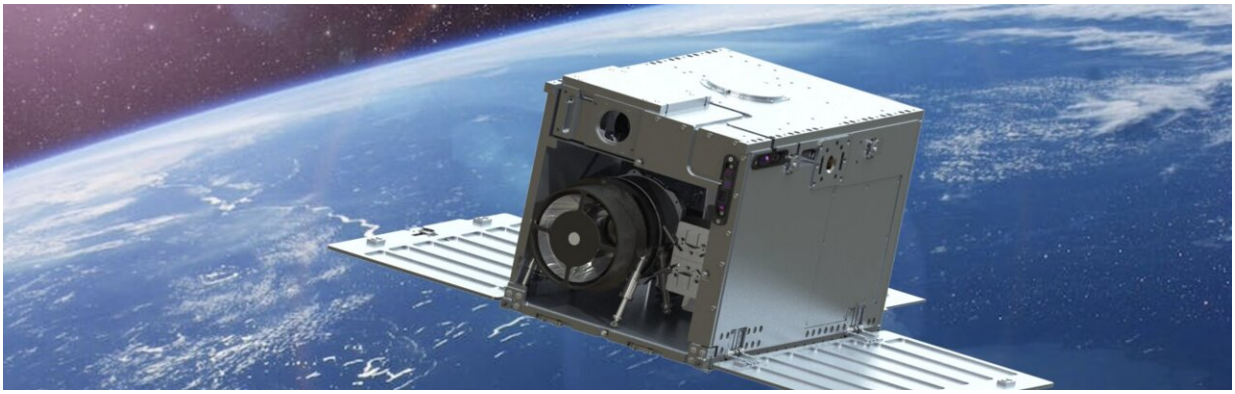
New keen-sighted satellite will view distant stars, assist Webb telescope

June 8 2023, by Daniel Strain



Artist's rendering of the MANTIS CubeSat, which will be about the size of a toaster oven, orbiting Earth. Credit: Dana Chafetz

NASA's James Webb Space Telescope (JWST), the most powerful telescope ever launched into space, will soon get a new "sidekick"—a small but nimble satellite that borrows its name from a multicolored sea creature.

Last month, NASA selected the $8.5 million space mission, which is called Monitoring Activity from Nearby sTars with uv Imaging and Spectroscopy (MANTIS). This CubeSat, or mini-satellite, will be about the size of a toaster oven and will be designed and built at the Laboratory for Atmospheric and Space Physics (LASP) at the University of Colorado Boulder.

Its moniker comes from the mantis shrimp, a crustacean known for its powerful punches and even more incredible eyesight. Like that undersea animal, the MANTIS spacecraft will be able to observe the night sky in the full range of ultraviolet light. That includes an especially energetic form of radiation called extreme ultraviolet (EUV) light.

"No spacecraft has observed the full EUV spectrum from stars other than the sun since about 2001," said Briana Indahl, a research scientist at LASP and principal investigator for the MANTIS mission.

The spacecraft will use its impressive vision to aid the Webb telescope, which launched in 2021, in its mission to explore the atmospheres of "exoplanets" beyond Earth's solar system. MANTIS, Indahl explained, will observe the volatile physics of stars burning dozens of light-years from Earth, including as they eject huge bursts of energy in the form of flares. Data from the craft will complement Webb's own observations of exoplanets, helping scientists piece together the conditions that could make these worlds habitable—or not.

"We proposed MANTIS as a kind of ultraviolet sidekick that will follow JWST and look wherever it's looking, filling in this important piece of context on the stellar environments in which these planets live," said Kevin France, an associate professor at LASP and scientist on the MANTIS team.

Indahl and her colleagues will soon begin work on MANTIS, which is scheduled to launch in 2026 and will spend about a year collecting data. The Italian Space Agency and Pennsylvania State University are technical partners on the mission.

A shrimp like no other

The key to MANTIS's success will come down to extreme ultraviolet

radiation, said David Wilson, who leads the mission's science team.

Stars, he explained, can shoot off this radiation in powerful but often short-lived explosions. Some planets may not fare well under those conditions.

"When those emissions hit the top of a planet's atmosphere, it will expand and some of it may escape into space," Wilson said. "If you have a high EUV flux, that planet's atmosphere may be quickly eroded away."

Measuring that radiation, however, gets extremely difficult. The last satellite to view this kind of light was NASA's Extreme Ultraviolet Explorer spacecraft, which operated from 1992 to 2001.

MANTIS, however, seeks to buck that trend using two high-tech telescopes packed into its small frame. The first will observe lower-energy ultraviolet radiation. The second will use a design that's never before flown into space to collect extreme ultraviolet light.

"For a lot of stars, this is going to be the first time we've seen what they look like in extreme ultraviolet," Wilson said.

The spacecraft builds on technology from two other CubeSats designed by the same team at LASP: The Colorado Ultraviolet Transit Experiment (CUTE), which launched in 2021 and is still gathering data today, and the Supernova Remnants and Proxies for ReIonization Testbed Experiment (SPRITE), which is expected to launch next year.

Indahl is excited to get started building the little satellite. She said that once MANTIS launches, it will zoom in on the same star systems as the Webb telesope. While the larger spacecraft observes the planets in those systems, MANTIS will take a look at their stars. Scientists may then be able to connect how energy from those stars influences the atmospheres

of orbiting planets—a coup for researchers looking for worlds like our own but far away.

"We're going to be observing stars of all different types, including a range of masses and ages," Indahl said. "We want to understand how this flux of UV light coming from stars affects the atmospheres of planets and even their habitability."

Provided by University of Colorado at Boulder

Citation: New keen-sighted satellite will view distant stars, assist Webb telescope (2023, June 8) retrieved 18 April 2024 from https://phys.org/news/2023-06-keen-sighted-satellite-view-distant-stars.html

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