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Astronomers propose giant space telescope to replace Hubble

Segmented mirror four or five times wider than Hubble's would peer directly at exoplanets.

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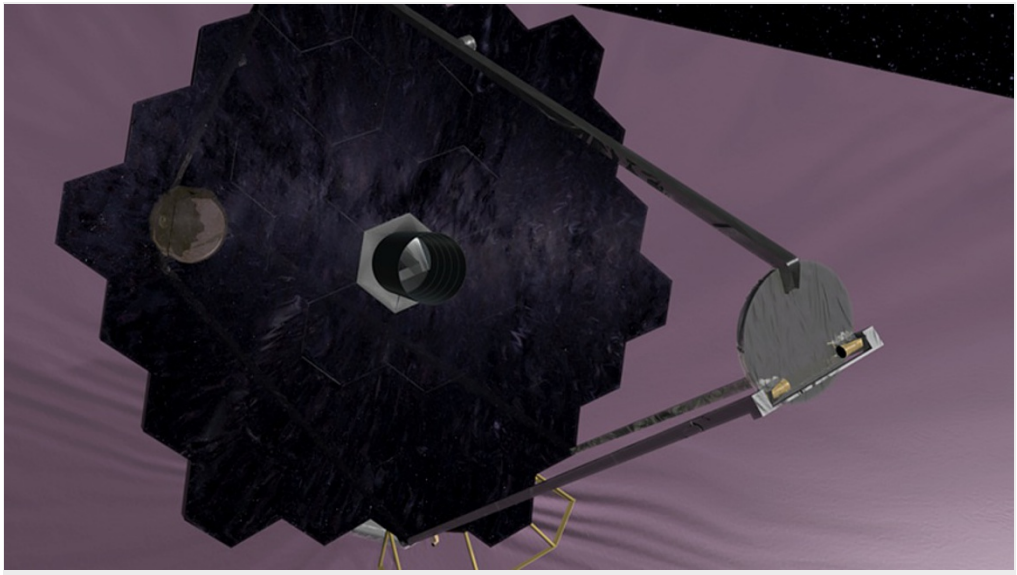

NASA/GSFC

The proposed High-Definition Space Telescope would have a tiled primary mirror at least 10 metres across.

An influential group of US astronomers has laid out its vision for the biggest and best space telescope yet — a worthy successor to the much-loved Hubble Space Telescope that some say could cost US$10 billion or more.

The proposed High-Definition Space Telescope (HDST) would have a mirror up to 12 metres across. That's 5 times the width of the 2.4-metre Hubble, which revolutionized astronomy with its sharp views of the cosmos, and nearly twice as wide as the James Webb Space Telescope (JWST), which is being readied for its 2018 launch. The HDST could finally answer the question of whether humans are alone in the Universe, by directly probing the atmospheres of dozens of extrasolar planets for signs of life. It could also dramatically reshape scientific understanding of how the Universe evolves.

“It’s hard to convey just how spectacular it’s going to be,” says report co-chair Julianne Dalcanton, an astronomer at the University of Washington in Seattle.

The report, released on 6 July by the Association of Universities for Research in Astronomy (AURA) in Washington DC, is so far merely a wish list: the HDST may never even make it to engineers’ drawing boards. But the study comes at a time when government funders are starting to think about the next decadal survey of US astronomy priorities, due in 2020. And its high-profile authors are likely to influence discussions of whether NASA should be pushing for another great space observatory in the decades to come.

It was a similar AURA report, in 1996, that eventually prodded Congress and NASA to fund and build the 6.5-metre Webb.

Wavelength gap

Hubble, which celebrated its 25th anniversary this year and is no longer receiving maintenance support from astronauts, is expected to last for another five or six years. By the time it stops working, the JWST should be in orbit, but the newer telescope will operate in different wavelengths from Hubble — using infrared rather than optical and ultraviolet light. After JWST, the next large space telescope in NASA’s queue is a mission called the Wide-Field Infrared Survey Telescope, but it too would operate mainly in the infrared.

Once Hubble goes, scientists will lose the ability to take jaw-dropping, Hubble-quality astronomical images in visible light, or to probe with a powerful space-based instrument the ultraviolet wavelengths that are washed out by Earth’s atmosphere. “What are we going to do to fill that gap?” asks Marc Postman, an astronomer at the Space Telescope Science Institute in Baltimore, Maryland, and a co-

author of the AURA report. “It begins to become a real issue.”

An HDST would need to be at least 10 metres across to be able to spy on the atmospheres of dozens of exoplanets — the number needed to establish decent statistics on whether life is common in the Universe, Postman says. The telescope’s upper size limit of 12 metres is dictated by how much weight a feasible rocket system could launch into space.

Folded mirror

Like the JWST, the HDST would launch folded up and then travel to the ‘L2’ stable gravitational point in space, 1.5 million kilometres from Earth, where it would unfold like a flower. But unlike the JWST, it would operate at roughly room temperature, eliminating the need for the complicated cooling systems that have contributed to huge cost overruns and delays on the $8-billion JWST.

The report’s authors are also trying to bring together two factions of astronomers: those who study exoplanets and those who study wider astrophysical questions. “We think the HDST will be a revolutionary telescope in many ways,” says Postman. “Now the challenge will be to get all those communities to agree that’s indeed what they want.”

NASA would almost certainly have to partner with other space agencies to turn the proposal into a reality. A full-scale HDST would likely cost $10 billion or more, says Alan Dressler, an astronomer at the Carnegie Observatories in Pasadena, California, who led the 1996 study that led to JWST. He argues that advocates might want to consider a scaled-down version of the HDST alongside the ambitious 12-metre proposal. “It would be most unfortunate if the scale was deemed just to big and there was no 'descope' to consider for a more modest — but still big — step in the same direction,” he says.

Dalcanton argues that the science of a full HDST will be worth it. “This is a mission that will never not look compelling,” she says. “Unless we’ve already built it.”

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