Plan for Telescopes on Moon's Far Side Is Revived

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Since the beginning of the space age, astronomers have dreamed of putting telescopes and other instruments on the far side of the moon.

Not only would that avoid all the distortions and disturbances caused by Earth's turbulent atmosphere, but equally important, the moon's mass would block the noisy torrent of radio signals emanating from Earth. Only in the moon's radio "shadow" could the farseeing radio telescopes envisioned for the future pick up the extremely faint signals left over from the early universe, signals that would otherwise be drowned out by the broadcast barrage from Earth.

But placing astronomy equipment on the always far side of the moon was well beyond the capabilities of the Apollo program, and no robotic lunar mission could do it either, which is why the telescopes were never developed.

With NASA planning to send astronauts back to the moon sometime after 2019, those dreams of a radio telescope looking out through the galaxies from the protected side of the moon have been revived. The agency recently awarded two planning grants for research on the necessary technologies and on how to put them in place.

The $500,000 grants to a team at the Massachusetts Institute of Technology and to the Naval Research Laboratory will be used to flesh out ideas for designing folded-up radio antennas that would pop open after being dropped on the lunar surface, for transmitting the flood of data that the antennas could theoretically collect, and for taking advantage of the planned presence of astronauts on the moon.

Nobody knows whether the ideas will work, whether they will be prohibitively expensive or whether NASA will even ultimately send astronauts back to the moon. But the researchers involved say that if the systems are developed and installed, they could help explain such profound, unanswered questions as how the galaxies formed from gas clouds in the early universe, how those gases came to be and what drove the initial expansion of the universe after the big bang.

"There is a very long period in the life of the universe, the so-called Dark Ages, that we know very little about," said Jack Burns, a professor and researcher at the Center for Astrophysics and Space Astronomy at the University of Colorado at Boulder. Burns, who has been working for almost 20 years on ideas for setting up radio telescopes on the far side of the moon, is working with the Naval Research Laboratory effort.

"The technology is feasible, and NASA wants those astronauts going back to the moon to have some scientific missions to work on," Burns said. "Deploying some kind of radio telescope makes a lot of sense."

Jacqueline Hewitt is leading the MIT group, which has begun to set up a planned 512 sets of dipole antennas -- like the old rabbit ears on early televisions -- at a site in largely uninhabited western Australia to test their radio telescope design. Team members are also focusing on developing the technology for creating and deploying the pop-open antennas for the moon.

"Our ambition is pretty large: to open up a new way of understanding how the universe was formed," Hewitt said. "We would be able to look back further than has been done before."

Both researchers want to build radio telescopes that can capture signals at the very long wavelengths generated by events that occurred within hundreds of thousands -- as opposed to billions -- of years after the big bang. At that time, the universe consisted largely of still mysterious dark matter, hydrogen and helium. Scientists have many theories about how that situation came to be and how it evolved into the vast galaxies and the universe we see today, and efforts to test those theories would benefit from the kind of data a moon-based radio telescope could provide.

While radio telescopes on Earth have become an important part of astronomy, their reach back in time is limited by the ionosphere -- the topmost, electrically charged layer of the atmosphere that reflects radio waves -- and by the jumble of radio transmissions from electronics, garage-door openers, and radio and television broadcasts on Earth.

On the side of the moon that always faces away from Earth, the telescopes would be protected from both types of radio interference.

To pick up the distant pulses, both teams envision placing a large number of modest antennas across a crater floor. While the MIT team is working on the pop-out antennas, which would transmit their data to receivers using laser technology, the Naval Research Laboratory plan calls for an array of similarly small antennas implanted in a thin polyimide film.

Burns said that he has worked with NASA on a prototype that could be placed by astronauts near the moon's south pole not long after the astronauts establish a settlement, but that a larger and far more powerful array would have to wait until NASA has more access to, and a better understanding of, the far side of the moon.

The early prototypes would not be able to gaze far into the past but could be useful for studying space weather, especially the enormous and powerful solar eruptions called coronal mass ejections. Those eruptions can disrupt communications and electrical grids on Earth and could be dangerous to astronauts on the moon or in space.

Both teams have one-year grants to develop their telescope arrays and have been encouraged to work together. According to Eric Smith, a project manager at NASA who helped select the two projects, strong support for the idea of placing a radio telescope array on the moon originated at a meeting of space scientists last year in Tempe, Ariz.

"One of the issues at the meeting was that if NASA is going back to the moon, what would we like to do there?" Smith said. "The astrophysicist group made their proposal to look at the very early universe, and that got a lot of support."

The two teams will present their proposals to a panel of the National Research Council, which will help set priorities for NASA funding in the next decade. If NASA gives the go-ahead, the researchers said, a radio telescope array on the far side of the moon would take years to develop and could cost about $1 billion.

Burns said he is encouraged.

"The far side of the moon is the quietest place in the inner solar system in terms of radio waves," he said. "If we could get a radio telescope working there, the results could be very dramatic."