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Sky at Night

THE UK'S BEST-SELLING ASTRONOMY MAGAZINE

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VAST LIQUID WATER OCEAN FOUND ON MARS

NEW PLAN TO BUILD A TELESCOPE ON THE MOON

ON TEST: ALTAIR BUDGET SCOPE AND ZWO MOUNT

Building a telescope on the Moon

Now might be the time to plan for an observatory on the lunar surface

Prof Chris Lintott is an astrophysicist and co-presenter on *The Sky at Night*

On 20 April 1972, astronaut John Young set up a small telescope in the shadow of the Orion lunar module that had carried him and Charlie Duke to a landing site in the lunar highlands. Over the course of the next few days, the astronauts used the telescope, sensitive to ultraviolet light, to observe Earth and the night sky, bringing back more than two hundred images.

Though this experiment in observing from beyond Earth's atmosphere was successful, fans of lunar astronomy are still waiting for the second telescope to be set up on our planet's companion. For many years, the cost of reaching the Moon and maintaining an observatory there would have been prohibitive, but with the cost of getting to (and beyond) Earth orbit dropping and multiple private companies sending craft to the Moon's surface (albeit for now with varying degrees of success), many have begun to think again.

This month's paper, from a US-based team, looks into what astronomers might get out of the Artemis programme, the troubled but still progressing plan to return NASA astronauts to the lunar surface. The design that is considered is a large interferometer, a device that combines light from one or more separate telescopes to provide sharper images than can be produced by one alone. On Earth, the size of such instruments is limited by what the shimmering atmosphere does to incoming starlight, so any lunar site has a serious advantage.

Upsides and pitfalls

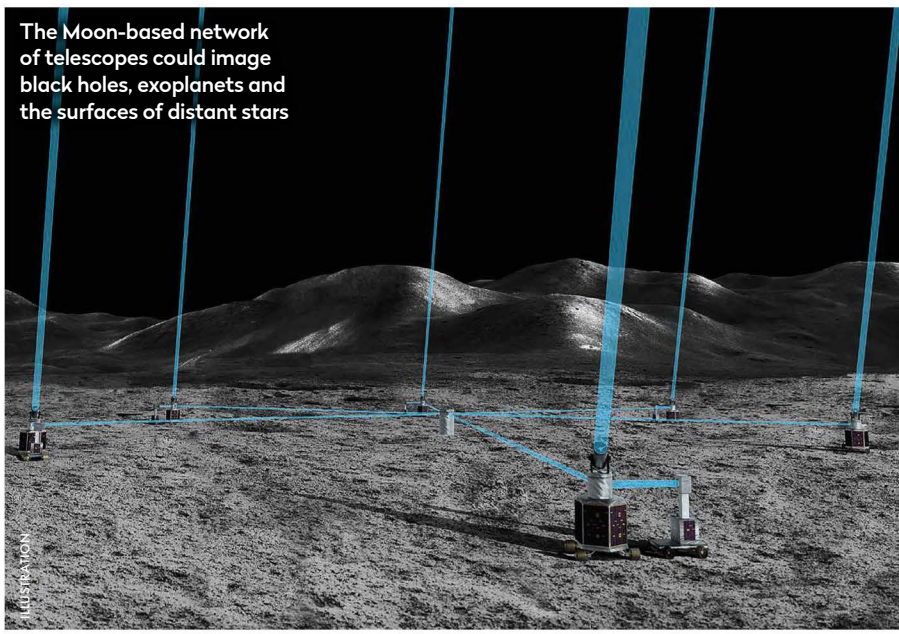
The proposed Artemis-enabled STellar Imager (AeSI) observatory would scatter small visible and ultraviolet instruments across a region of the lunar south pole 500 metres across. The resolution would allow us to see starspots on the surface of Sun-sized stars within about 13 lightyears, and on giant stars that are much further away. We might also see new detail in the accretion discs that surround supermassive black holes in nearby active galaxies, and much more.

"The proposed observatory would scatter small visible and ultraviolet instruments across a region of the lunar south pole 500 metres across"

The main point of the paper, which describes the beginning of the study, is that there's a lot to think about. The dusty lunar environment, for example, might quickly degrade the quality of the optics in any telescope; astronauts in a new lunar base presumably have better things to do than wander around re-aluminising telescope mirrors. The large swings in temperature between lunar day and night pose engineering problems too.

Still, if one can be successfully designed, it might be significantly cheaper and easier than the other, space-based option, which would require developing technology such that fleets of telescopes can seamlessly fly in formation with unprecedented accuracy. With radio astronomers also thinking about an array of telescopes on the lunar far side, shielded from terrestrial radio chatter, the astronomical lunar race may finally be on.

We'd better get a move on, though. The very expansion of access to the lunar surface that makes projects like AeSI possible may also threaten the utility of the lunar surface for astronomy. If there are too many visitors, dust and disruption will follow, along with an increased number of satellites in the lunar sky. For astronomers with grand plans, it's clear that they should get to the Moon before everyone else does.



The Moon-based network of telescopes could image black holes, exoplanets and the surfaces of distant stars

Chris Lintott was reading... *Artemis-enabled Stellar Imager (AeSI): A Lunar Long-baseline UV/Optical Imaging Interferometer* by Gioia Rau et al.
Read it online at: arxiv.org/abs/2408.04699