

# A 4G network on the moon is bad news for radio astronomy

November 4 2020, by Emma Alexander

---



Credit: CC0 Public Domain

As you drive down the road leading to Jodrell Bank Observatory, a sign asks visitors to turn off their mobile phones, stating that the Lovell telescope is so powerful it could detect a phone signal on Mars.

Radio telescopes are designed to be incredibly sensitive. To quote the legendary astronomer [Carl Sagan](#), "The total amount of energy from outside the solar system ever received by all the [radio telescopes](#) on the planet Earth is less than the energy of a single snowflake striking the ground."

The total energy now is probably a few snowflakes' worth, but nevertheless it is still true that astronomical radio signals are typically magnitudes smaller than artificial ones. If Jodrell Bank could pick up interference from a phone signal on Mars, how would it fare with an entire 4G network on the Moon?

That is the issue that is worrying astronomers like me, now that [Nokia of America](#) has been awarded US\$14.1m (£10.8m) for the development of the first ever cellular network on the Moon. The [LTE/4G network](#) will aim to facilitate long term lunar habitability, providing communications for key aspects such as lunar rovers and navigation.

## **Network interference**

Radio frequency interference (RFI) is the long-term nemesis of radio astronomers. Jodrell Bank—the earliest radio astronomy observatory in the world still in existence—was created [because of RFI](#). Sir Bernard Lovell, one of the pioneers of radio astronomy, found his work at Manchester hampered by RFI from passing trams in the city, and he persuaded the university's botany department to let him move to their fields in Cheshire for two weeks (he never left).

Since then, radio telescopes have been built more and more remotely in an attempt to avoid RFI, with the upcoming Square Kilometer Array (SKA) telescope being built across remote areas of South Africa and Australia. This helps to cut out many common sources for RFI, including mobile phones and microwave ovens. However, ground-based radio

telescopes cannot completely avoid space-based sources of RFI such as satellites—or a future lunar telecommunications network.

RFI can be mitigated at the source with appropriate shielding and precision in the emission of signals. Astronomers are constantly developing strategies to cut RFI from their data. But this increasingly relies on the goodwill of private companies to ensure that at least some radio frequencies are protected for astronomy.

A long-term dream of many radio astronomers would be to have a radio telescope on the far side of the Moon. In addition to being shielded from Earth-based signals, it would also be able to observe at the lowest radio frequencies, which on Earth are particularly affected by a part of the atmosphere called [the ionosphere](#). Observing at low [radio frequencies](#) can help answer fundamental questions about the universe, such as what it was like in the first few moments after the big bang.

The science case has already been recognized with the [Netherlands-China Low Frequency Explorer](#), a telescope [repurposed](#) from the Queqiao relay satellite sent to the Moon in the Chang'e 4 mission . NASA has also funded a project on the feasibility of turning a [lunar crater into a radio telescope](#) with a lining of wire mesh.

## **It's not just 4G**

Despite its interest in these radio projects, NASA also has its eye commercial partnerships. Nokia is just one of 14 American companies NASA [is working with](#) in a new set of partnerships, worth more than US\$370m, for the development of its Artemis program, which aims to return astronauts to the Moon by 2024.

The involvement of private companies in space technology is not new. And the rights and wrongs have long been debated. Drawing possibly the

most attention has been SpaceX's Starlink satellites, which caused a stir among astronomers after their first major launch in 2019.

Images quickly began to emerge with trails of Starlink satellites cutting across them—often obscuring or outshining the original astronomical targets.

Astronomers have had to deal with satellites for a long time, but Starlink's numbers and brightness are unprecedented and their orbits are [difficult to predict](#). These concerns apply to anyone doing ground-based astronomy, whether they use an optical or a radio telescope.

A [recent analysis](#) of satellite impact on radio astronomy was released by the SKA Organization, which is developing the next generation of radio [telescope](#) technology for the Square Kilometer Array. It calculated that the SKA telescopes would be 70% less sensitive in the radio band that Starlink uses for communications, assuming an eventual number of 6,400 Starlink satellites.

As space becomes more and more commercialized, the sky is filling with an increasing volume of technology. That is why it has never been more important to have regulations protecting astronomy. To help ensure that as we take further steps into space, we'll still be able to gaze at it from our home on Earth.

This article is republished from [The Conversation](#) under a Creative Commons license. Read the [original article](#).

Provided by The Conversation

Citation: A 4G network on the moon is bad news for radio astronomy (2020, November 4) retrieved 26 April 2024 from <https://phys.org/news/2020-11-4g-network-moon-bad-news.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.