Astronomers scan the center of the Milky Way for any sign of intelligent civilizations, find nothing but silence

February 15 2022, by Evan Gough

You too can gaze at the Milky Way in wonder, and ponder the existence of other technological civilizations. You probably have to leave the city though. Credit: P. Horálek/ESO

Are there civilizations somewhere else in the universe? Somewhere else

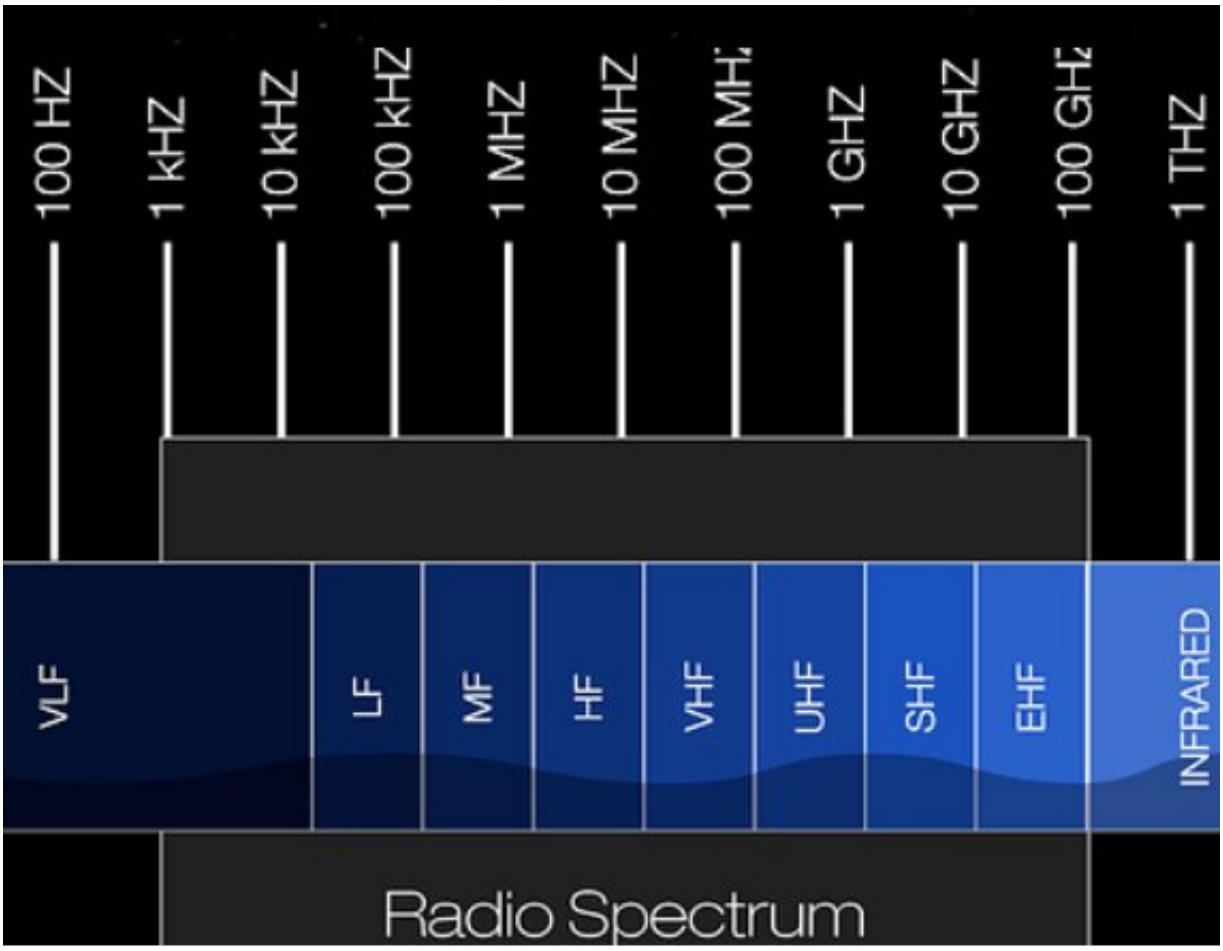
in the Milky Way? That's one of our overarching questions, and an answer in the affirmative would be profound.

Humanity has pursued the search for extraterrestrial intelligence (SETI) in one form or another since shortly after the advent of radio waves in the early 20th century. Efforts have waxed and waned over the decades, but the search has never been completely abandoned.

The search detected transient hints in the form of unexplained radio waves in the past, but nothing that comprises reliable evidence. Now, a new search for technosignatures in the Milky Way's center has turned up nothing.

If we ever discover or come into contact with another civilization, it'll be an almost mystical moment for our species. People would divide into different camps and ideologies pretty quickly, and start arguing what to do about it. Many of us would pour out into the streets and look at our brother and sister humans with renewed wonder.

We should probably tap the breaks, though. If humanity ever discovers life elsewhere, it'll likely be single-celled life somewhere in our solar system. Maybe one of the solar system's moons harbors bacteria in their subsurface oceans.



This image shows a portion of the electromagnetic spectrum focusing on radio waves. Credit: NASA

But when we gaze at the night sky and wonder if we're alone, most of us are thinking of more complex lifeforms. We wonder if there are other technological civilizations out there, facing the same challenges as us and puzzling over their own origins and fates like we do.

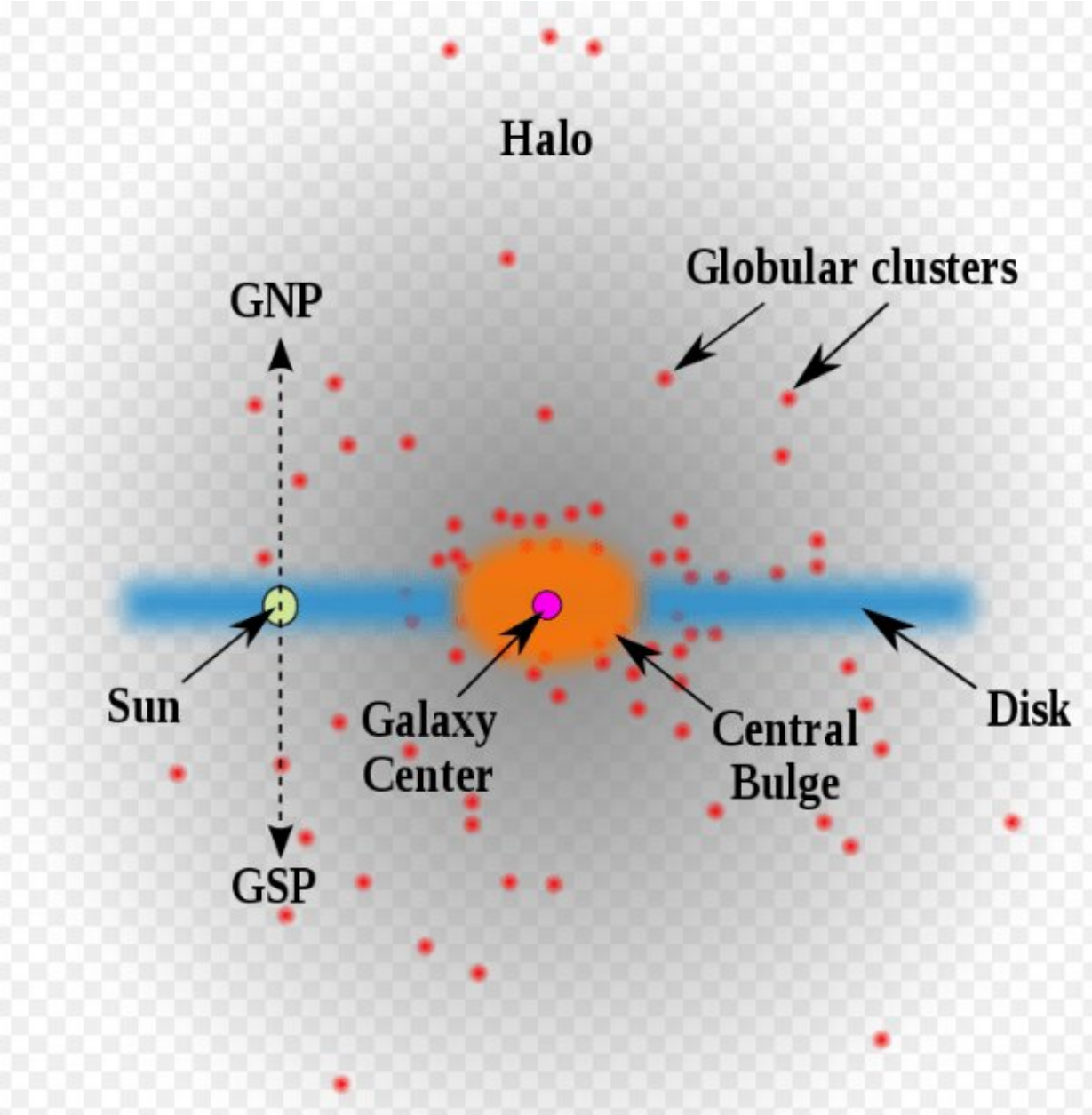
A new paper titled "A Search for Technosignatures toward the Galactic Centre at 150 MHz" is the fourth in a series. Each of the four is a search for low-frequency radio waves using the Murchison Widefield Array

(MWA) in Australia. The lead author is Chenoa Tremblay from the Commonwealth Scientific and Industrial Research Organisation (CSIRO.) The paper is available on the pre-press site arxiv.org.

The results come from seven hours of observations over two nights with the MWA. The search was aimed at the galactic center, focused on Sagittarius A*, the supermassive black hole at our galaxy's core. The searchers targeted their search for technosignatures on 144 exoplanetary systems.

The search for life focuses on biosignatures. Biosignatures are things like molecules or isotopes that indicate the presence of life. Technosignatures are different.

Different researchers describe technosignatures differently. But in broad terms, technosignatures are evidence of effects that can only result from the use of technology. Mega-engineering projects like Dyson spheres can leak radiation that could be detected. A sufficiently advanced civilization might be able to build them, or even to alter the orbits of stars. Those phenomena would be good evidence for another technological civilization. More mundane things like chlorofluorocarbons in an atmosphere would also be evidence, but maybe harder to detect.



A simple schematic of the Milky Way. Credit: RJHall at English Wikipedia, CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=52696960

Some researchers don't consider radio waves to be technosignatures since they can be produced naturally. But in terms of any widespread

surveys of large regions of space, radio waves are the most practical thing to search for. The recent observations with the MWA was tuned to 155 Mhz.

Radio signals are still the bedrock in SETI. That's partly because they're an early indicator of a technological species, most likely, and the ability to produce radio waves and detect them likely comes early. It did in our case. The authors write, "The existence of both powerful transmitters and sensitive receivers at low frequencies—both of which emerged early in the history of radio engineering—motivates low-frequency technosignature searches by providing an example class of engineered signals to search for, and instruments with which to do so."

This search was aimed at the galactic center purely for economy of effort and results: it has the most stars. We don't where to look or not look to improve our chances, because we haven't discovered another technological civilization yet. In the search for extraterrestrial intelligence, it makes sense to cast our net wide. "The galactic center (GC) is a prime SETI target as the line of sight toward the GC has the largest integrated count of galactic stars for any direction," the authors write in their paper.

They point out that there are some reasons both for and against targeting the GC.

The stellar density in the GC has a good and bad side. Sure, there are more stars, which means more potential planets and civilizations. But more stars isn't necessarily better. "The high density of stars within the GC means that cataclysmic events such as stellar supernovae and magnetar flares are more likely to impact exoplanets within the GC, potentially destroying any life on their surface," they write.

With so many stars in the densely packed GC, stellar flybys are more

likely. Those are bad news for life, let alone civilization. They can disrupt protoplanetary disks and interfere in the planet formation process.

But on the other hand, the GC is also a promising place to look. "Despite these factors, modeling by Gowanlock et al. (2011) finds a majority of planets that may support complex life are found toward the inner galaxy (less than 1 kpc from the galactic center). Morrison & Gowanlock (2015) extend this model to include intelligent life, and also find higher probability within the inner galaxy," the authors write.

A 2021 study shows that even with all the hazards in the GC, it's still the best place to look. "A line of sight toward the galactic center (GC) offers the largest number of potentially habitable systems of any direction in the sky," the authors of that paper say. And if an intelligent civilization gets up and going, its best chances of spreading is in the tightly packed GC, where the stars aren't so far apart.

The recent search was aimed at 144 exoplanet systems, but it also completed a wider blind search of over 3 million stars toward the galactic center and the galactic bulge. The authors write that "No plausible technosignatures are detected."

In the end, saying no signatures were detected doesn't mean there aren't any signals to be detected. It just means that at this particular time, using the specific ramifications of this search methodology, no signals were detected.

Should we be sad?

Maybe not. Each of these attempts reveals something about the search method, and provides a chance to improve methods in the future. The holy grail in the search for technosignatures is probably an all-sky

search, but that's something we need to work our way toward. "However, before we get to all-sky technosignature searches, there are a number of computational challenges to overcome and these surveys have provided insight on how to accomplish this goal with an aperture array," the authors write.

So for now, we're alone. There's no other technological civilizations to rendezvous with. It's still a dream.

But maybe we should flood into the streets and look at our human brothers and sisters with renewed wonder anyway.

What can it hurt?

More information: Chenoa D. Tremblay, Danny C. Price, Steven J. Tingay, A Search for Technosignatures toward the Galactic Centre at 150 MHz. arXiv:2202.03324v1 [astro-ph.GA], arxiv.org/abs/2202.03324

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