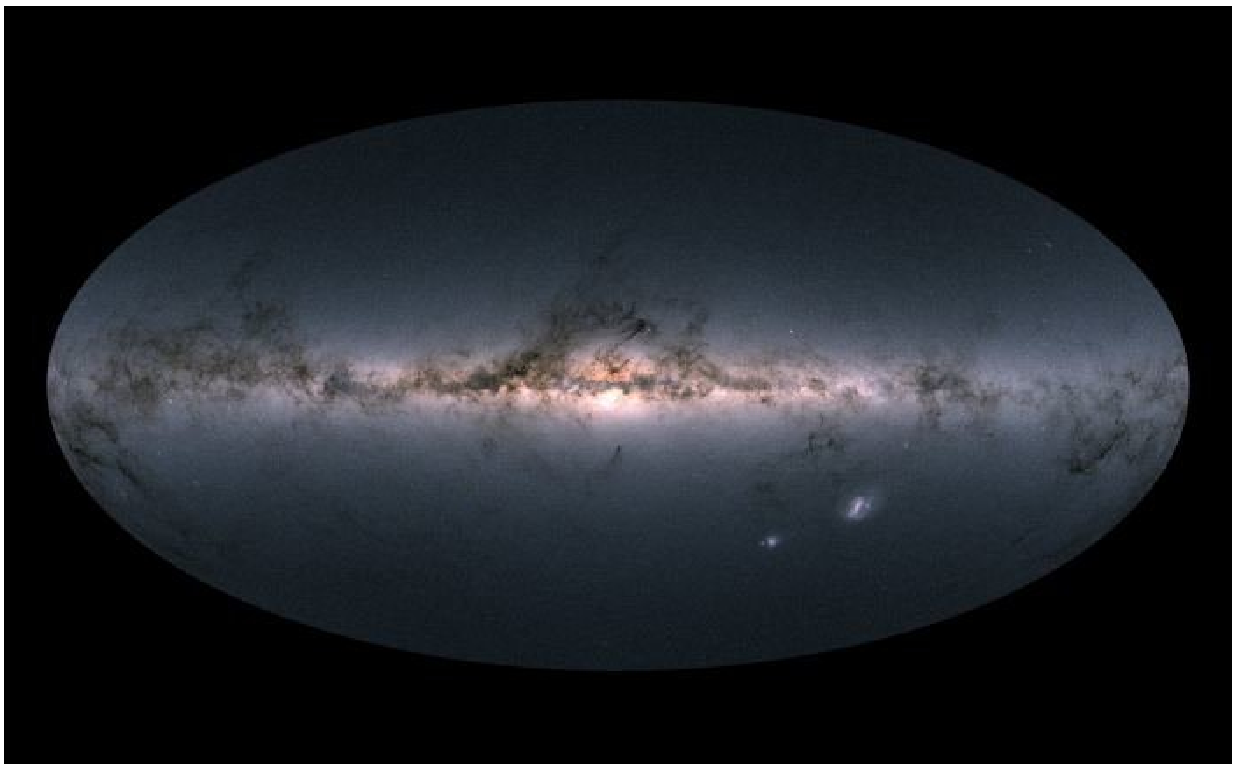
New model predicts that we're probably the only advanced civilization in the observable universe

June 22 2018, by Matt Williams



According to a new theory argued by Anders Sandberg, Eric Drexler and Toby Ord, the answer to the Fermi Paradox may be simple: humanity is alone in the universe. Credit: ESA/Gaia/DPAC

The Fermi Paradox remains a stumbling block when it comes to the search for extra-terrestrial intelligence (SETI). Named in honor of the famed physicist Enrico Fermi who first proposed it, this paradox addresses the apparent disparity between the expected probability that intelligent life is plentiful in the universe, and the apparent lack of evidence of extra-terrestrial intelligence (ETI).

In the decades since Enrico Fermi first posed the question that encapsulates this paradox ("Where is everybody?"), scientists have attempted to explain this disparity one way or another. But in a new study conducted by three famed scholars from the Future of Humanity Institute (FHI) at Oxford University, the paradox is reevaluated in such a way that it makes it seem likely that humanity is alone in the observable universe.

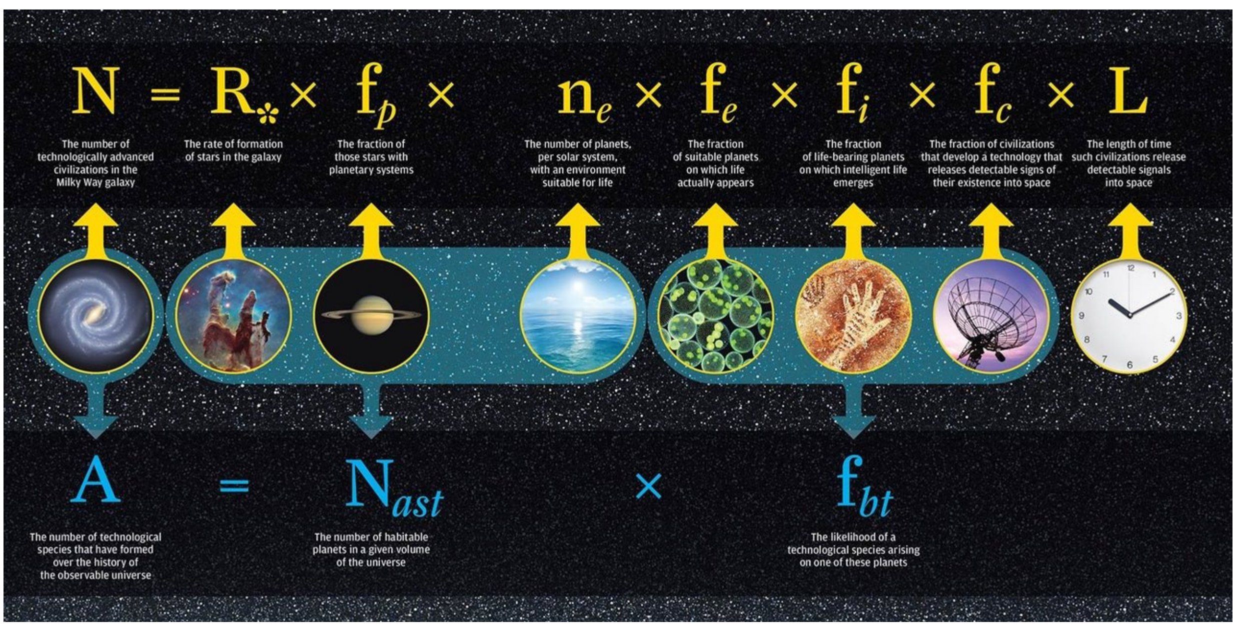
The study, titled "Dissolving the Fermi Paradox", recently appeared online. The study was jointly-conducted by Anders Sandberg, a Research Fellow at the Future of Humanity Institute and a Martin Senior Fellow at Oxford University; Eric Drexler, the famed engineer who popularized the concept of nanotechnology; and Toby Ord, the famous Australian moral philosopher at Oxford University.

For the sake of their study, the team took a fresh look at the Drake Equation, the famous equation proposed by astronomer Dr. Frank Drake in the 1960s. Based on hypothetical values for a number of factors, this equation has traditionally been used to demonstrate that – even if the amount of life developing at any given site is small – the sheer multitude of possible sites should yield a large number of potentially observable civilizations.

This equation states that the number of civilizations (N) in our galaxy that we might able to communicate can be determined by multiplying the average rate of star formation in our galaxy (R*), the fraction of those stars which have planets (fp), the number of planets that can actually support life (ne), the number of planets that will develop life (fl), the number of planets that will develop intelligent life (fi), the number civilizations that would develop transmission technologies (fc), and the length of time that these civilizations would have to transmit their signals into space (L). Mathematically, this is expressed as:

$N = R^* \text{ x } f_p \text{ x } n_e \text{ x } f_l \text{ x } f_i \text{ x } f_c \text{ x } L$

Dr. Sandberg is no stranger to the Fermi Paradox, nor is he shy about attempting to resolve it. In a previous study, titled "That is not dead which can eternal lie: the aestivation hypothesis for resolving Fermi's paradox", Sandberg and his associates proposed that the Fermi Paradox arises from the fact that ETIs are not dead, but currently in a state of hibernation – what they called "aestivation" – and awaiting better conditions in the universe.



The Drake Equation, a mathematical formula for the probability of finding life or advanced civilizations in the universe. Credit: University of Rochester

In a study conducted back in 2013, Sandberg and Stuart Armstrong (also a research associate with the FHI and one of the co-authors on this study) extended the Fermi Paradox to look beyond our own galaxy, addressing how more advanced civilizations would feasibly be able to launch colonization projects with relative ease (and even travel between galaxies without difficulty).

As Dr. Sandberg told Universe Today via email:

"One can answer [the Fermi Paradox] by saying intelligence is very rare, but then it needs to be tremendously rare. Another possibility is that intelligence doesn't last very long, but it is enough that one civilization survives for it to become visible. Attempts at explaining it by having all intelligences acting in the same way (staying quiet, avoiding contact with us, transcending) fail since they require every individual belonging to every society in every civilization to behave in the same way, the strongest sociological claim ever. Claiming long-range settlement or communication are impossible requires assuming a surprisingly low technology ceiling. Whatever the answer is, it more or less has to be strange."

In this latest study, Sandberg, Drexler and Ord reconsider the parameters of the Drake Equation by incorporating models of chemical and genetic transitions on paths to the origin of life. From this, they show that there is a considerable amount of scientific uncertainties that span multiple orders of magnitude. Or as Dr. Sandberg explained it:

"Many parameters are very uncertain given current knowledge. While we have learned a lot more about the astrophysical ones since Drake and Sagan in the 1960s, we are still very uncertain about the probability of life and intelligence. When people discuss the equation it is not uncommon to hear them say something like: "this parameter is uncertain, but let's make a guess and remember that it is a guess", finally reaching a result that they admit is based on guesses. But this result will be stated as single number, and that anchors us to an *apparently* exact estimate – when it should have a proper uncertainty range. This often leads to overconfidence, and worse, the Drake equation is very sensitive to bias: if you are hopeful a small nudge upwards in several uncertain estimates will give a hopeful result, and if you are a pessimist you can easily get a low result."

As such, Sandberg, Drexler and Ord looked at the equation's parameters as uncertainty ranges. Instead of focusing on what value they might have, they looked at what the largest and smallest values they could have based on current knowledge. Whereas some values have become well constrained – such as the number of planets in our galaxy based on exoplanet studies and the number that exist within a star's habitable zone – others remain far more uncertain.

When they combined these uncertainties, rather than the guesswork that often go into the Fermi Paradox, the team got a distribution as a result. Naturally, this resulted in a broad spread due to the number of uncertainties involved. But as Dr. Sandberg explained, it did provide them with an estimate of the likelihood that humanity (given what we know) is alone in the galaxy:

"We found that even using the guesstimates in the literature (we took them and randomly combined the parameter estimates) one can have a situation where the mean number of civilizations in the galaxy might be fairly high – say a hundred – and yet the probability that we are alone in the galaxy is 30%! The reason is that there is a very skew distribution of likelihood.

"If we instead try to review the scientific knowledge, things get even more extreme. This is because the probability of getting life and intelligence on a planet has an *extreme* uncertainty given what we know – we cannot rule out that it happens nearly everywhere there is the right conditions, but we cannot rule out that it is astronomically rare. This leads to an even stronger uncertainty about the number of civilizations, drawing us to conclude that there is a fairly high likelihood that we are alone. However, we also conclude that we shouldn't be too surprised if we find intelligence!"

In the end, the team's conclusions do not mean that humanity is alone in the universe, or that the odds of finding evidence of extra-terrestrial civilizations (both past and present) is unlikely. Instead, it simply means that we can say with greater confidence – based on what we know – that humanity is most likely the only intelligent species in the Milky Way Galaxy at present.

And of course, this all comes down to the uncertainties we currently have to contend with when it comes to SETI and the Drake Equation. In that respect, the study conducted by Sandberg, Drexler and Ord is an indication that much more needs to be learned before we can attempt to determine just how likely ETI is out there.

"What we are not showing is that SETI is pointless – quite the opposite!" said Dr. Sandberg. "There is a tremendous level of uncertainty to reduce. The paper shows that astrobiology and SETI can play a big role in reducing the uncertainty about some of the parameters. Even terrestrial biology may give us important information about the probability of life emerging and the conditions leading to intelligence. Finally, one important conclusion we find is that lack of observed intelligence does not strongly make us conclude that intelligence doesn't last long: the stars are not foretelling our doom!"

So take heart, SETI enthusiasts! While the Drake Equation may not be something we can produce accurate values for anytime soon, the more we learn, the more refined the values will be. And remember, we only need to find intelligent life once in order for the Fermi Paradox to be resolved.

More information: Dissolving the Fermi Paradox. arxiv.org/abs/1806.02404

Provided by Universe Today