Gods Galactica, The Kardashev Scale: Mankind's Future Destiny Prophesized

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"*But where is Everybody?*" asks the Fermi Paradox in the 1950's regarding intelligent civilizations in the universe. In 1964, a 32-year-old Soviet/Russian astrophysicist named Nikolai Semyonovich Kardashev, who was at the time the deputy director of the Astro Space Center of the Institute of the Russian Academy of Sciences in Moscow, was perplexed by the lack of evidence in the cosmos for technologically advanced civilizations in the universe. According to simple mathematics, assuming we live on an average planet in an average part of an average galaxy, there should be thousands of similar species living on thousands of home planets that are within sight of our telescopes.

Image of the night sky above Paranal, Chile on 21 July 2007, taken by ESO astronomer Yuri Beletsky. (Beletsky CC BY-SA 4.0)

The Fermi Paradox

Kardashev, who died in 2019, was by no means the first to ponder this question. Enrico Fermi, for instance, the Italian physicist who created the world's first nuclear reactor, earning for himself the title 'architect of the nuclear age', is said to have been in conversation over lunch with Edward Teller, Herbert York and Emil Konopinski back in the summer of 1950. The intellectual powerhouse gathering of scientists had been talking about recent UFO reports and the possibility of traveling faster than the speed of light. They were all in agreement that since there are billions of stars in the Milky Way, there was

a statistically high probability that many of them have planets orbiting them that were similar to Earth. Many must be much older than our sun, which would have given them plenty of time to develop intelligent life. Some of them must have by now developed interstellar travel, and must have located, or at least tried to contact, Earth at some point. The conversation moved on to different topics, as such conversations often do, until Fermi suddenly blurted out, "*But where is everybody?*" Since this conversation occurred, his simple question has taken on epic proportions. It has even been given an official title: the Fermi Paradox.

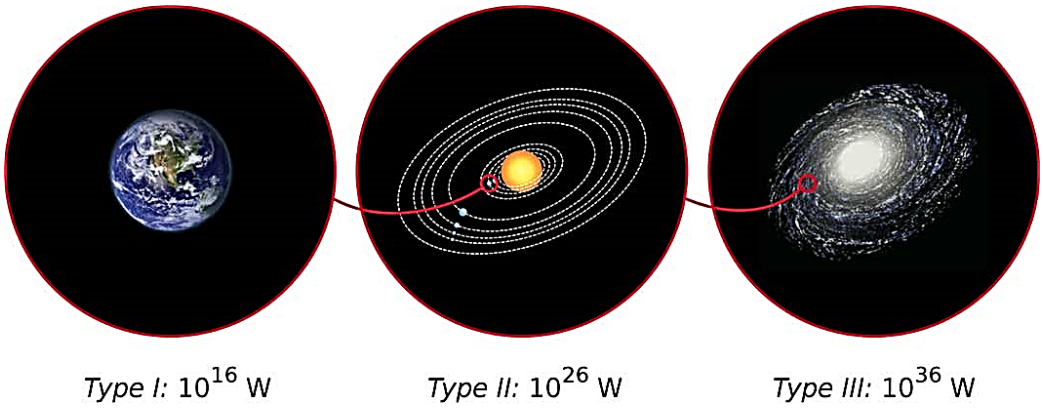
The Kardashev Scale

It was this question that haunted Nikolai Kardashev. Being the brilliant scientist he was, he decided to formally study the problem. By so doing, he created what is now called the *Kardashev Scale*. It suggests a method of describing the growth expectations of a potential civilization. He theorized that a civilization's development depends upon, or is a product of, its use of energy and technology.

Technology is powered by energy, harnessing and employing it in ways that fuel cultural development. The greater the utilization of an energy source, the greater the development of a civilization. Kardashev originally limited his studies to one area – that of communication. But his ideas have since been expanded to include much wider, and more speculative, fields.

Soviet and Russian astrophysicist Nikolai Semenovich Kardashev. (CC BY-SA 4.0)

To make a long story short, he developed a futuristic scale that measured how civilizations might develop and predicts methods that could result in far more advanced methods of getting around in the cosmos and, eventually, beyond. Although he limited himself to only three advanced categories, they have now been expanded to include far more hypothetical civilizations.



Energy consumption estimated in three types of civilizations defined by Kardashev scale (Indif / CC BY-SA 3.0)

Kardashev's Levels of Civilization

Type 0: The Sub-Global Civilization

A sub-global civilization derives all its energy and raw material from organic-based, native materials. It is powered by plant and animal-based sources, including coal, wood, and oil. If such a civilization tries to leave its home planet, it is forced to use forms of chemical propulsion, which are entirely inadequate when it comes to overcoming the immense distances of space and time. If this scenario sounds familiar, it is because it describes exactly the plight of humankind on planet Earth. Currently, we are not yet even registering on the Kardashev Scale.

The late physicist from Cornell University, Carl Sagan, once tried to determine mathematically how long it might take us to break into the big leagues of interplanetary communication and travel. He followed the work of others who have attempted similar paths of study, but his approach became arguably the most well-known. This is his formula:

$$\mathrm{K} = \frac{log_{10}P - 6}{10}$$

In this way of looking at the problem, K, on the left, represents the Kardashev Rating. The equation on the right is designed to determine a civilization's power output, measured in watts. For those who cannot remember, or never learned, advanced physics, the equation generally concludes that we are currently utilizing about 75% of power available on our planet. (Remember, though, that Sagan established these figures in the 1970s.) Based on computations that some consider irrefutable, and others call somewhat frivolous, Sagan placed us at about 0.72 on the Kardashev rating, and estimated it would take us at least another 100 years to reach the bottom end of the scale.

Type 1: The Planetary Civilization

This civilization has learned the basics of efficiently utilizing all their available resources, not just the 75% or so that Carl Sagan figured we are using. Science-fiction buffs might remember a Flash Gordon, Buck Rogers-type television culture that was popular back in the 1950s. Rocket ships were powered by chemical fuel. The energy output of our planet is, assuming we do not first blow ourselves up or damage our environment to the point of no return, sufficient only to begin the arduous journey to the stars, a journey which we have started just in the last 60 years.

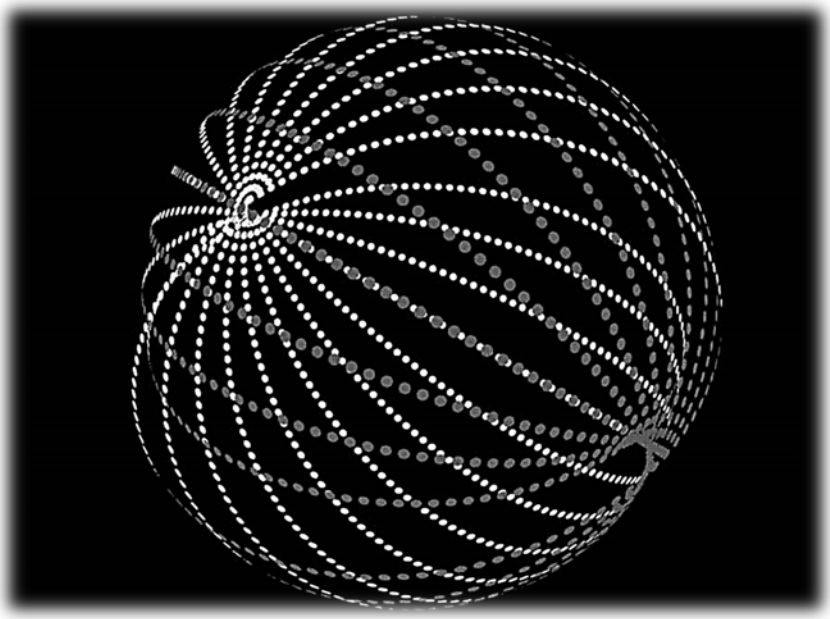


Figure of a Dyson swarm surrounding a star (CC BY-SA 2.5)

Type 2: The Stellar Civilization

A civilization that reaches stage 2, perhaps a few thousand years into our future, has learned to harness energy not just from its home planet, but from its local star as well. In our case, that means our sun.

Science fiction buffs will now start to think about television's *Star Trek and the Federation of Planets*. This is the point when concepts such as the Dyson Sphere enter the picture, which is the result of a thought experiment popularized by Freeman Dyson in 1960. He theorized that since only a fraction of the sun's energy reaches earth, if we were to somehow build a structure that would completely encircle a star, capturing all of its energy output, we could greatly increase our use of its available power. He even suggested we might want to start searching for such structures out in the far reaches of the universe. It would be proof that the Kardashev Scale had practical implications throughout the cosmos.

The idea was popularized in an October 1992-episode of *Star Trek, the Next Generation*, written by Ronald D. Moore. In this episode, the intrepid members of the Starship Enterprise encounter just such a structure, escaping only with the help of Montgomery Scott, the beloved engineer who is reconstituted and brought back to life after 80 years or so spent in suspended animation.

The Large Magellanic Cloud, a dwarf galaxy. At a distance of 163,000 light-years, it is the third closest galaxy to the Milky Way. (NASA Public Domain)

Type 3: The Galactic Civilization

As implied by its title, a Galactic Civilization has advanced far enough to utilize the energy output of an entire galaxy. According to Sagan, we will need to wait at least another million years or so to get this far up the scale. This civilization has colonized and assimilated its entire galaxy. Now we are into *Darth Vader / Galactic Empire / Borg: "Resistance is futile*," territory. (For some reason, we always seem to assume this type of civilization is evil. That may say more about us than them.) With this kind of energy at its disposal, a Galactic Civilization, having evolved far beyond any limits of which we can presently conceive, outside of science fiction, has made the leap to interplanetary space, and perhaps even time.

In 2015, scientists studying the Kardashev Scale came to the conclusion that there are probably no Type 3 civilizations within the limits of our immediate neighborhood. Hopes were raised in 2016, when an apparent signal from star HD164595 indicated a possible power source of Type 3 proportions. But it was later determined that the signal most likely originated from a military satellite in orbit around the earth.

Type 3 was as far as Nikolai Kardashev was willing to go. But that has not stopped others from continuing.

Universal Civilization, Immortal and God-like (CC0)

Galactic Gods

Type 4: The Universal Civilization

This civilization is a truly intergalactic culture, at home throughout the entire universe. Imagine the power output of a billion, trillion suns, or the ability to exist within the event horizon of immense black holes. They will probably be, for all practical purposes, immortal and god-like. Science fiction aficionados will no doubt now be thinking about Star Trek's "*Q-Continuum*." We would probably not be able to even detect such civilizations unless they chose to reveal themselves, because their existence would be indistinguishable from nature and physics.

Type 5: The Multiverse Civilization

A Multiverse Civilization has transcended their universe of origin. They are, for all practical purposes, gods. Think about jumping back and forth between universes, of having the infinite power of the entire material realm at your disposal. There are, as far as we can imagine, no limits to what they could do. They could even custom design entire universes, and create sentient creatures 'in their own image', or at least the image of what they once were.

They can custom design entire universes (Julius H. / Pixabay)

We could continue. Many have. Type 6 and 7 civilizations are theorized, and some people even go up to level 12. By this time, it is easy to simply delegate all such ideas to the trash bin of mindless fun and theoretical frivolity. But before you do, stop and consider something. Go back to the original reason Nikolai Kardashev began this exercise. He was wondering what might happen to civilizations at various stages of their development. He was trying to answer Enrico Fermi's paradoxical question: "*If the universe is full of intelligent civilizations, where is everybody?*"

Civilizations Destruct

Perhaps the answer is a simple one. Maybe we do not see them because evolution is haunted by a perplexing decision: Do we evolve, or do we destroy ourselves? It might turn out that the most difficult transition in any civilization's evolution is the step from Type 0 to Type 1. That is the place we find ourselves in right now. We have the power to save ourselves. We also have the power to destroy ourselves. Which path will we take? Has our technology exceeded our wisdom?

Destruction, from The Course of Empire by Thomas Cole (1836). (Public Domain)

Between what was and what will be there is always a time of chaos, in which the future is unclear.

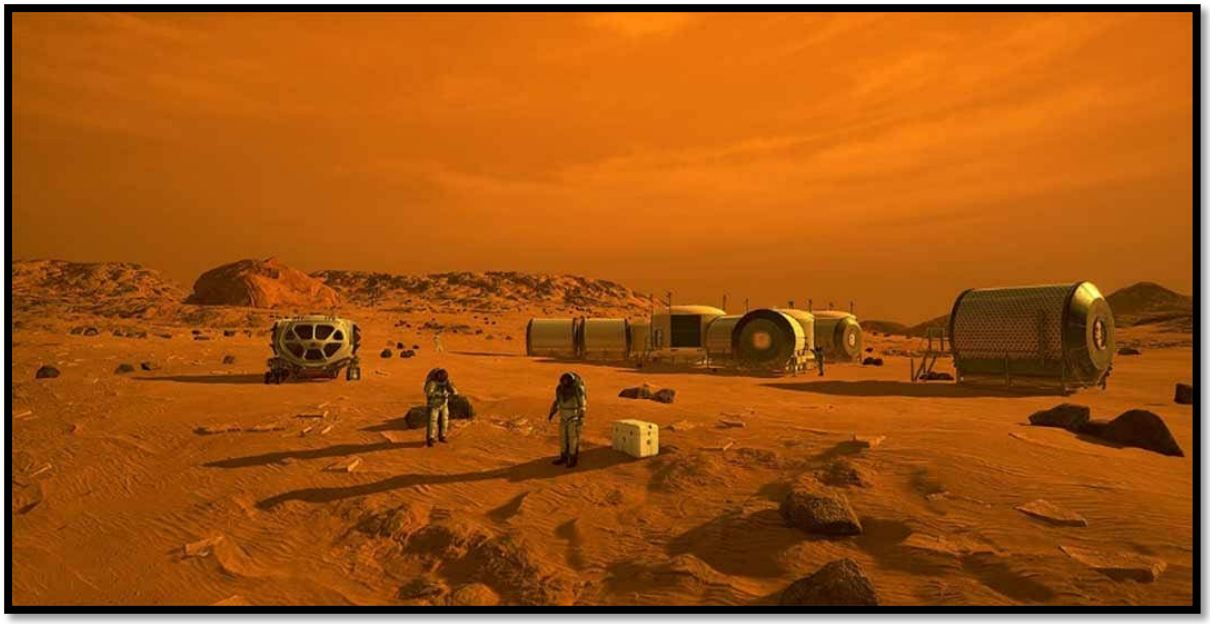
Consider the fall of the Roman Empire, for instance. When it was destroyed by forces from within and without, the world fell into what are often called The Dark Ages. But the Dark Ages harbored the seeds of what would later bloom into the flower of the Enlightenment. It was a chaotic era. It must have seemed to people at the time as if the splendor that was once Rome would never be seen again. Little did they know that even greater things lay before them.

Do we live in similar times? Are the best days of human civilization behind us? Or is there a greater future ahead that we cannot even begin to imagine? We might even want to go one step further. Has this happened before, right here on planet Earth?

The Portrait of Michel de Nostredame (Nostradamus), a French Renaissance Medicine & Astrologer, painted by his son César de Nostredame (1553-1630) (Public Domain)

Frankly, no one knows. Some are hopeful. Others are filled with despair. And our plight is not new. In the past, the words of prophets, not just religious voices, but those of secular seers as well, such as Edgar Cayce and Nostradamus, have prepared us for the worst. NASA has opened windows to the skies, which have provided a wonderful view, but also warned us about collisions with envoys from outer space, such as comets and asteroids. They have visited before. And they will certainly visit again.

The newspapers daily warn us about environmental collapse and are harbingers of wars and rumors of war. Meanwhile, the occasional high-tech terrorist attack reminds us how fragile our infrastructure really is. Pandemics, often thought to be a thing of the past, have recently brought the entire world to its knees. Fires and floods, hurricanes and other disasters, either natural or not, are daily in the news. And the power politics of those who seek to build their own status in our culture, continue to peer out from behind tightly drawn curtains.



NASA concept for first humans on Mars, with a habitat and rover, 2019 (Public Domain)

On the other hand, if we part those curtains, and throw open the windows on what is happening, there is an equal, perhaps even better than equal, chance that our natural proclivity toward peace and justice, scientific understanding, and compassionate consciousness, can rise above this time of chaos and point to a future that is bright indeed. We cannot flinch from the truth. But we do not have to be held hostage to fear, either. Our civilization's crossroad is fast approaching, if it is not already here. We need to learn all we can, so as to make informed decisions. Perhaps contemplating ideas such as those of Nikolai Kardashev can indeed open our minds to a bright future.

Top Image: Panspermia theory argues that life came to Earth from elsewhere in our galaxy or even further away.(Dmitry / Adobe Stock)

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