(IJIASE) 2019, Vol. No. 5, Jan-Dec **e-ISSN: 2454-9258, p-ISSN: 2454-809X**

AN ANALYTICAL STUDY OF THE KARDASHEV SCALE IN THE INTERPRETATION OF ENERGY USAGE BY CIVILIZATION

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Humans are used to classifying whatever they have around them, and what they see, there are many ways to classify objects that we see all around us, there are many categories in which things we see have been calculated but this is the first scale that I have seen that gives classification to not an existing object but something that has an idea, this is not entirely explored, and we don't even know if it is out there or neither can we confirm the existence of the things we are classifying.

The Kardashev scale classifies civilizations based on how much energy they intake is done by a civilization the more energy taken by a civilization the tiger they get on the scale. This scale does not only stop on a planet; instead, it goes far out of what an average person thinks about or even is capable of right now to execute. On this scale, we would be talking about civilizations that are less advanced than us and civilizations that are more advanced than us.

The scale uses energy as its medium to classify civilizations. While this board is lonely like the universe, there is no other civilization that humans, there can be some nonexistent civilization on the scale. But that does not help in comparing humans in the real world.

"Energy is the currency of the universe" stated Emily Martian, who is an award-winning writer, poet, and philosopher. Energy is used in everything even the tiniest moment in the cells of your body need energy I am using energy to type the computer is gaining energy as it is getting charged and losing energy as it is working on getting any output we would need an input of energy, to produce any object, glass paper or laptop energy is used. The Death of a star gives energy, nuclear fusion happening through the lifetime of a star provides energy. The only difference in the course of energy above is the amount of energy, a star exploding would give humongous amounts of energy and would be visible from billions of light-years light energy from a laptop screen would not be even visible from a few meters. Everything requires energy. We need heat energy to keep the Earth warm we need energy for our fans to work we need the energy to do basic stuff in our own body like movement and thinking. The same thing is different here to the amount of energy.

Energy is used in everything it is a very efficient way to classify civilizations based on the energy intake,

as seen above everything needs energy we need energy to do anything, classifying civilizations based on energy intake this scale includes different levels which are called types and would go through various stages which would have a different and a new object that would be needed to harness energy from.

This Research would include

- History about the person ie, Kardashev
- Types/levels of the scale
- What is our progression, where would we see ourselves in the future
- People who tried to add to the scale
- Additional types that were added to the scale
- Critics that oppose the scale
- Calculation/Formula
- Flaws
- The idea for new scales
- My perspective

HISTORY

The scale named after its maker Kardashev who's full name is Nikolai Semenovich Kardashev, was a Soviet and Russian astrophysicist, Doctor of Physical and Mathematical Sciences, and the deputy director of the Astro Space Center of PN Lebedev Physical Institute of the Russian Academy of Sciences in Moscow.

Kardashev graduated from Moscow State University in 1955, following up at Sternberg Astronomical Institute. He studied under Iosif Shklovsky and finished his Ph.D. in 1962.
In this work, he came up with the idea that some galactic civilizations would be perhaps millions or billions of years ahead of us and created the Kardashev classification system to rank such civilizations. Kardashev defined three levels, based on energy consumption: type1 type2 type3 Serious Russian efforts in SETI predate similar programs in the United States by some years. Other notable experts in the Soviet Union were Vsevolod Troitsky and Shklovsky.
Kardashev became a corresponding (associate) member of the USSR Academy of Sciences, Division of General Physics and Astronomy on December 12, 1976. He became a full member of the Russian Academy of Sciences on March 21, 1994, and was awarded the Demidov Prize in 2014.

Kardashev was born in 1932, and sadly he passed away just before my paper, on August 3, 2019, Kardashev had passed away. In 1963 he conducted the first Soviet search for extraterrestrial intelligence (SETI) by examining the quasar CTA-102 for signs of a technological civilization. In the following year,

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Kardashev organized the first Soviet conference on communication with extraterrestrial intelligence (CETI) at Byurakan Observatory in Armenia.

In 1964, Kardashev proposed a scale that now bears his name, which is used for classifying extraterrestrial civilizations in terms of their energy use.

ORIGINAL SCALE

The original scale made by Kardashev in 1964 has 3 levels of classification which are Type1, Type2, Type3

Type 1 civilisation

This civilization is called a planetary civilization it would be able to harness energy from the whole planet, every solar energy coming from the star, every gust of wind, every tide in every ocean. This is the closest type to humans. Humans are currently 0.73 civilization on the Kardashev scale. It is presumed that humans will reach type 1 in 100 years.

As a type I civilization, it would be capable of controlling the planet entirely, influencing the weather, controlling volcanic eruptions, and earthquakes, global flora, fauna, geological makeup, plate tectonics, etc. A type 1 civilization would need to move to interplanetary settlement once all the energy has been harnessed.

Type 2 civilisation

This civilization is known as a stellar civilization. This civilization would extend to the whole stellar system. This includes everything that is present in the system, all the planets, all the asteroids, and the main energy beast, the star which is giving out a humongous amount of energy.

This civilization would be spread out throughout the solar system. They would be harnessing energy from all sources present in the solar system. After a civilization has conquered type 1, the first step in type 2 civilization would be easy colonizing and using all the energy from the planet as the technology is present with the civilization they would just have to travel to the different planets and set up the machines.

The project of asteroid mining would solve the puzzle of mining the asteroids for fuel water and even metals.

The major challenge in proceeding to type 2 civilization would be to harness the energy of the star present in the middle of the system. There are a few concepts for building a complex structure around the whole star which absorbs all the light given by the star. The complex structure named the Dyson sphere would be a large sphere around the star and would take all the energy that is given out.

With the Dyson sphere and the advancements in the technology comes some problems, for example, the Dyson sphere would block all the heat energy coming from the star, and hence the solar system would cool down, this would not be a major challenge as the energy from the sun would be enough to actually create the heat for Earth, there a problem with the Dyson sphere any impacts on the spheres outer shield would make it collapse into the star and the whole project would be destroyed, there is a problem of installation and material, If people do install it they would be very close to the star and if machines do what do they would have to be built with. Even after the Dyson sphere is built as there would be no light coming to Earth photosynthesis would not occur (big problem), but this can also be solved as we would be getting a huge amount of energy from the star.

Let's assume a civilization has conquered all the problems and now are expanding. What is the next step?

Type 3 civilisation

This is civilization known as a galactic civilization which is so advance they expand through a galaxy. This civilization much like the Earlier on has two major tasks to do expand to through the whole galaxy going star to star building Dyson spheres, but the major challenge for this civilization to get to type 3 would be to get the energy from the supermassive black hole that is in the center of the galaxy

Another challenge had hit us. This is difficult we need to harness energy from an object that takes everything in it and even light cannot pass through. One of the methods to harness energy from a black hole is to cover it with a similar Dyson sphere, but this time it would not have to be a kind that absorbs energy instead of a kind but reflects, sort of a concave mirror, but it is a whole circle. With that built some advanced assembly would be required and if something falls it's no return. After the whole structure has

been created it would be opened with a small door, and a beam of light would be shot into it, and the rotational energy would increase the energy of the light beam then the sphere can be opened again, and the energy of the light beam would get absorbed. Another way is to create a back hole bomb, hear the black hole is feed with planets and stars taken to the black hole and once it reaches full capacity it would blast and give a tremendous amount of energy but this would dismantle the whole galaxy and stars would leave each other and fly off into space with their planets.

ADDITIONS TO THE KARDASHEV SCALE

It is unsure who was a single person to add in the Kardashev scale as there were a lot of attempts the following is an example of the addition to the scale

Type 0 civilisation

Humans already have passed through this stage. This civilization is the one that needs the lowest amount of energy taking only the energy required for their survival for example food like animals and crops, fire and that's what they need the most minimal energy.

nothing special has to built except a multicellular organism capable enough to be conscious and move to protect and hunt

Type 4 civilisation

Yes, there is more this civilization goes far ahead, this reaches the unreachable, literally. To be called a type 4 civilization, some work needs to be put in. This civilization would need to reach galaxies in the local group, a group of 30 galaxies out of which the universe expands at the speed of light, hence it is not reachable until we don't go faster than light. This civilization would have to get energy from anywhere possible far planets every star every black hole. For that, civilization would have to go out of its local gel group. Hence to reach this level, the people would have to crack a few things, going more than the speed of light and getting to higher life spans. It is speculated that civilizations this advance would live inside back holes!
Well cracking the speed lights means that they could escape the black hole.

Type 5 civilisation

Could there be something more advance for people who have explored the whole universe? Well, yes, people have added this level to blow people's minds of literally. This level deals with the concept of a multiverse; this is alternate realities of the same moment or millions and billions of universes living at the

same moment but cannot be seen.

This civilization would have all the energy in the universe, but why stop. This would mean the civilization would have to create some way to travel between alternate realities, the multiverse Harnessing energy from different universes and using it.

Type 6 civilisation

The final position for any civilization the ultimate People. These would be godlike to us right now. This civilization can create multiverses, planets, stars, black holes whatever they want. They would have the power to destroy anything or create anything. This civilization breaks one of the fundamental laws of the universal law of conservation of mass "matter can neither created nor be destroyed" and well while creating stars they break another law first law of thermodynamics "energy can neither be created nor be destroyed." Hence the additional scales classify them as GODS. It says that this civilization would have so much computing power that the consciousness of each person living in that civilization that has expanded through the universe can be uploaded on that computer. This does make me think is
"Are we real or just an experiment conducted by a type 6 civilization to see how is a civilization expanding?"

Humans

Where are humans on the scale where we would be heading and how much time until we take the energy of a black hole or our sun?

The earlier human fossils have been dated to 6-7 million years ago. So we can say that it took humans 6-7 million years to get to type 0.73 on the Kardashev scale, which is a long time but short seeing how humans have progressed we have come a long way from spears to civilizations to numbers, languages and electronics buildings — seeing some people have tried to guess how many years.

Humans will reach type 1 in 100-200 years. It is said that Humans would take another few thousands or ten thousand years, to reach the ultimate level type 3 civilization we would need 100,000 years to a few million years to colonize the galaxy.

Criticism

It has been argued that, because we cannot understand advanced civilizations, we cannot predict their behavior. Thus, the Kardashev scale may not be relevant or useful for classifying extraterrestrial civilizations. This central argument is found in the book Evolving the Alien: The Science of Extraterrestrial Life. written by Cohen and Stewart

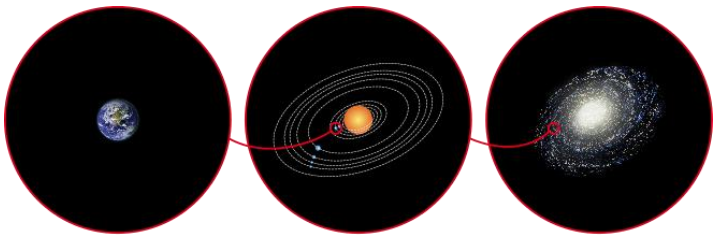
Cohen and Stewart argue against a conception of extraterrestrial life that assumes life can only evolve in environments similar to Earth (the Rare Earth hypothesis), and that alien lifeforms will converge toward characteristics identical to those of life on Earth, a common trope of certain science-fiction styles. They suggest that any investigation of extraterrestrial life relying on these assumptions is overly restrictive, and it is possible to make a scientific and rational study of the possibility of life forms that are so different from life on Earth that we may not even recognize them as living in the first instance.

Calculation

A formula has been provided in which we can give the kardashev scale reading or the power input and we can get the missing value

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

By putting in either the value of power(p) or the value of the kardashev scale we can get to know the value that is unknown



Type I : 10^{16} W *Type II* : 10^{26} W *Type III* : 10^{36} W

Flaws in the scale

There are three flows that I pointed in the Kardashev scale

1. The difference in the different levels of the scale and the energy is tremendous. the scale I very compressed and there need to be more levels to the scale
2. The classification of the civilizations is done on the basis of energy. This is not a very good way as there could be a civilization classified as type 2 and using all the energy from the star into a project that would

not help then like creating a moon which they don't have the requirement of.

3. The classification of civilizations on the based on energy. In the future, if we classify aliens on the basis of energy, the aliens may be bigger in size and need more energy or could be smaller and need lesser energy. Energy is an excellent way to classify civilizations, but I feel there are better ways to classify civilizations.

HOW DO WE FIX THE FLAWS

1. People have tried extending the scale to type 4,5,6, but that is not what I mean, by the expansion I mean expanding the whole scale like making type 3 civilization called a type 30 by this we can have more division and civilizations can get a better look with going up a step as they use more energy. One example can be given by using the type 1 and type 2 civilizations. Let's assume that the type 1 civilizations remain at the same place and we add more types in the middle and rename the type 2 to type 4. The two types in the middle can be described by saying that type civilization is on that uses the energy from two different planets, and type 3 could be done by saying that the civilization uses the energy from all the planets in its system and then type 4 which includes the energy of the star. This became easier to understand, and it can be understood as instructions.
2. The classification of the civilization should be done on the basis of the energy intake and then subtracting the amount of energy wasted, this would give us how much energy a civilization is using for the development and wasted energy in projects that would not be helpful for them, for example, making rockets go into space and seeing what happens and repeating it
3. Catering to the problem in the third point. I have made multiple scales by looking into the faults that I saw in the previous scale making new scales (will be in the final draft) based on various unique aspects like the expansion of the civilization through the planet and outer space etc. even attempted to expand the previous scale from Kardashev

SCALES

1. Energy/ Kardashev scale (this is an expansion of the scale made by Kardashev)

In this scale the civilisations are classified using the energy input and subtracting that with the energy wasted.

New levels to the scale have been added to make the scale bigger

- Type 0.1 - Harvesting energy required only for the survival
- Type 1 - Harvesting energy from one entire planet <— Humans remain same 0.73
- Type 3 - Harvesting energy from two planets
- Type 4 - Harvesting energy from all the planets of the solar system

- Type 5 - Harvesting energy from the star
- Type 6 - Harvesting energy from two stars and the planets orbiting the two stars
- Type 7 - Harvesting energy from all the stars in the galaxy
- Type 8 - Harvesting energy from the Black hole
- Type 9 - Harvesting energy from two galaxies, both black holes all the stars all the planets
- Type 10 - Harvesting energy from whatever can be reached

This scale can be read as a type of instruction. This is more easy to follow. I have not included going outside the local group/ anything reachable as for that we need to conquer the speed of light which is not possible as of today.

2. Radius of exploration

This scale compares how much a civilisation has explored their planet or how much a being or the life form has gone out into space

- Type 0.1 - Exploring from an original place
- Type 1 - Exploring more that 10 body lengths
- Type 3 - Exploring more that 100 body Lengths
- Type 4 - Exploring the whole planet
- Type 5 - Exploring the nearest celestial object (moon/ planet) <—Humans went to the moon
- Type 6 - Exploring the furthest celestial object in the solar system
- Type 7 - Exploring the closest star to the system star
- Type 8 - Exploring the furthest star in the galaxy
- Type 9 - Exploring the closest galaxy
- Type10- Exploring the furthest reachable galaxy

3. life span

This scale compares the original average life span of a civilization and the current life span of a civilisation. By this we are comparing the medical advancement.

- Type 0.1 - Increased by 10%
- Type 1 - Increased by 50%
- Type 3 - Increased by 75%
- Type 4 - Increased by 100%<—Humans have grown from 35 to 75 years(increased 114.28%)
- Type 5 - Increased 10 times the original
- Type 6 - Increased 50 times the original

- Type 7 - Increased 75 times the original
- Type 8 - Increased 100 times
- Type 9 - Increased 150 times
- Type 10 Reached immortality

4. How may digits of π have been taken out

This scale classifies civilisations on the basis of there mathematical understanding of a simple shape and the computing power

- Type 0.1 - The concept of π has not yet originated
- Type 1 - Till 10th digit
- Type 3 - Till 1000th digit
- Type 4 - Till 1 million th digit
- Type 5 - Till 1 billion th digit
- Type 6 - Till 1 trillionth th digit<— humans have calculated 31.4 trillion digits with the use of AI
- Type 7 - Till 1 quadrillion th digit

The scale would go on with the multiplication of 1000 to the previous number

MY THINKING

I don't think any of these scales can classify correctly as they focus on only one aspect like lifespan or exploration. To make a perfect scale, we include every scale that is mentioned above to give the civilization a value from every aspect. For this, I introduce the Ultimate scale.

ULTIMATE SCALE

This scale can be called the father of the scales as this includes all the scales. it would not have any levels, but a value can be calculated by doing a simple formula that consists of the values of the type of the civilization from the four scales that I have proposed, the amount of the civilization can be taken out by using a simple formula :

A_v = multiplication of the value of the types of the different calculation for the Earth for a value on the Ultimate scale A_v Earth = 0.73 x 5 x 6 x4

A_v Earth = 87.6

I feel that this scale would be at the top and would be very useful to use instead of a scale that just focusses on the energy here there is no type 0 as then in the formula multiplying 0 would give us a zero as an answer. Hence every scale that makes the bigger scale starts with 0.1.
This scale really would compare civilisation on the basis of 4 broad fields and not just one.

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