Dyson Spheres

Source: TH

Dyson spheres are **hypothetical megastructures** built around a star to harness its entire energy output.

- Named after **physicist Freeman Dyson**, these structures would collect all of a star's radiant energy.
- Detecting a Dyson sphere could indicate a **technologically advanced alien civilization** that prefers not to communicate.
- **Earth receives 1,361 watts per square meter** from the sun, a tiny fraction of the sun's total **energy output of 380 billion quadrillion watts per second.**
    - **A Dyson sphere would capture all this energy that otherwise radiates into space.**
- The **Kardashev Scale** is a **theoretical framework to measure a civilization's level of technological advancement** based on its energy consumption.
    - **Humanity is currently at Kardashev Type 0.7449**, not fully utilising the energy available on Earth.

Kardashev Type	Energy Consumption (Watts/second)	Description
Type I	10^16	Harnesses all energy available on its planet
Type II	10^26	Harnesses all energy from its star
Type III	10^36	Harnesses energy on a galactic scale

- While **theoretically possible, constructing a Dyson sphere presents immense challenges** in terms of resources, engineering, and time.
- Various projects, such as **Project Hephaistos, have sought Dyson swarms using data from infrared surveys**. While several objects have been identified, most have been ruled out as natural objects.

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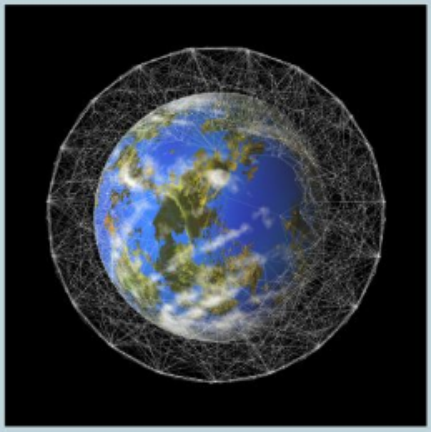
KARDASHEV SCALE: MEASURING A SUPERCIVILIZATION

Astrophysicist Nikolai Kardashev proposed in 1962 that very old and advanced civilizations would likely be of three types:



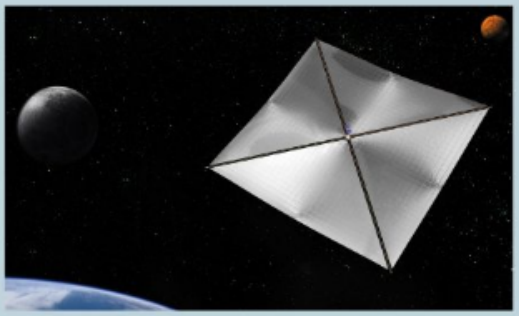
TYPE I CIVILIZATION harnesses all the resources of a planet. Carl Sagan estimated that Earth rates about 0.7 on the scale.

TYPE II CIVILIZATION harnesses all the radiation of a star. Humans might reach Type II in a few thousand years.

TYPE III CIVILIZATION harnesses all the resources of a galaxy. Humans might reach Type III in a few hundred thousand to a million years.

SOLAR SAILING: THE KEY TO FORMING A DYSON SPHERE

A solid shell around a star would be gravitationally unstable, and would probably require more material than all of the planets of a solar system could provide. Instead, practical Dyson spheres would be made from millions of individual solar-collecting satellites.



Solar sails (left) could remain in place by balancing against the pressure of light from the sun. The satellite would not be in orbit, it would actually hover in space. Such a satellite is called a "statite."

Rings of statites would form a cloud around the star, collecting its energy and beaming it back to the home planet.

Read more: [Planetary Instability in Twin Star Systems]