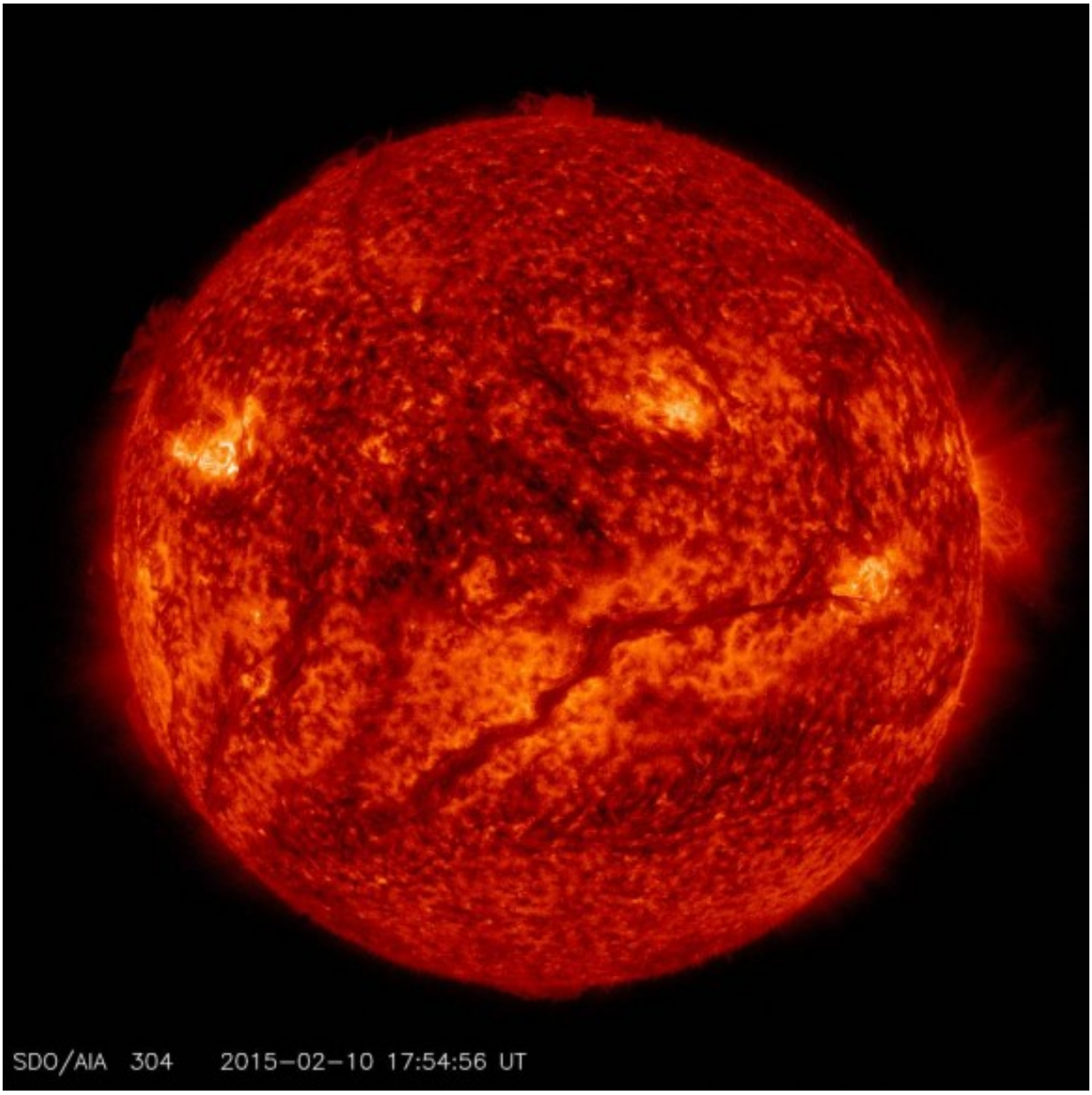
When will we be a type III civilization?

July 6 2016, by Fraser Cain



To be a Type II civilization, all you need to do is wrap the sun in a Dyson sphere.

Easy. Credit: NASA/SDO

Now, I'm no futurist, but I think I can predict one thing. Humans love to use energy, and in the future, we're going to use even more of the stuff.

Let's hope it's clean energy, like that handy source of photons in the sky: the Sun. Not dirty forms of energy, like screams, unobtainium, liquid Shwartz, or using humans as batteries.

Once we really get our hands on a clean, unlimited source of energy, you can expect our usage to grow and grow until every human on Earth is using as much energy as a small country.

We will climb our way up through the Kardashev scale of energy usage, from Type 1, to Type II to Type III. Type III! Can you even imagine what would happen at that point?

Oh, you have no idea what I'm talking about? No problem.

The Kardashev Scale was originally developed by the Soviet astronomer Nikolai Kardashev in 1964. He looked at the advancement of humanity's need for energy, and then just extrapolated when what our future energy demands would look like – and how they'd be supplied.

He broke them into three types. A Type I civilization would have complete and total mastery over all the energy of its planet. A Type II civilization would be masters of all the energy produced by their home star, and a Type III civilization would own all the energy in their home galaxy.

It was a pretty clever way to categorize the mighty capabilities of future

civilizations, and it's fueled the imagination of many sci-fi writers.

Where are we now along the Kardashev Scale? How long will it take for us to unlock each civilization level? Assuming we survive, of course.

Kardashev estimated that the total energy usage of a Type I civilization based on the amount of sunlight that falls on Earth. Our planet receives about 2 x 10^17 watts of power from the Sun.

Is that a lot? Is sure sounds like a lot. In 2013, the total human power consumption was 12.3 terawatts. So, doing a little math, we get about 1/14,000th the total potential power output that falls on the Earth.

It sounds like we've got a long way to making up that difference. But wait a second, we're in the realm of exponential growth now, which has a surprising way of sneaking up on you.

Freeman Dyson, the famous physicist, estimated that it'll only take about 200 years to fully utilize the energy falling on the Earth. That seems amazing, but when you consider that Germany was able to pump out 25 gigawatts of power in April, 2015, it doesn't stretch your imagination too far.

Where do we go from there?

A Type III civilization would have control over all the energy of their galaxy. Credit: Randy Halverson

Kardashev estimated a compounding energy usage of 1% per year. And so, if you extrapolate forward from our current energy usage, he figured it would take about 3,200 more years to reach Type II status, where we're extracting 100% of the energy pouring out of the Sun – all 4 x 10^26 watts.

Probably by using Dyson sphere, cloud or other Dyson-related polygon. We might have to dismantle all the planets to do it, but that's just what we'll do to keep up with our ravenous energy needs.

I know you look around your house, see your various appliances, and you're unable to imagine how you could use that much power. But trust me, you will. You might have nanofactories, spinning out furniture made

of pure diamond. Or a massive, planet-sized computer calculating the answer to life the universe and everything. Or a console that'll let you play Witcher 3 without dropping frames. When energy is cheap and clean, all kinds of impossible ideas become reasonable.

Continuing this 1% compounding energy usage, Kardashev figured we'd be using up all the energy of our host galaxy within a few hundred thousand years – 10^37 watts -, but that's mostly because of the time it takes to travel to from star to star. The Milky Way measures 120,000 light-years across, so even colonizing the entire galaxy couldn't happen faster than that.

Imagine an entire galaxy, with every solar system completely dismantled and every star enclosed in a Dyson cloud of energy extracting solar cells. And yet, constant growth inevitably predicts it.

Is that it? Is that as much as a future civilization could colonize? Hardly, they would really just be getting started. A future civilization with that much energy at their disposal would be able to expand outward at just shy of the speed of light, eventually colonizing everything that the laws of physics would enable them to get to.

Eventually the expansion of the Universe, accelerated by dark energy would bring their colonization to a stop. Galaxies would drop over the cosmic horizon, forever out of reach. Vast cosmic power with no where else to go.

Thanks to Kardashev, we've got a great way of considering our place in the Universe. Assuming we don't wipe ourselves out, we've got a bright future ahead.

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