What To Do When The Sun Will Brighten?

By Abraham Loeb on October 25, 2019

Ecclesiastes was not accurate in stating that “there is nothing new under the Sun”. In about a billion years the Sun will brighten up so much that it will boil off the oceans on Earth. This raises concerns for people who think long-term, such as the BBC radio reporter who asked me recently for my thoughts on how to mitigate this risk for the future of humanity.

The simplest solution that came to my mind is to spray a blanket of particles into the stratosphere that would reflect sunlight and cool the Earth, in a way similar to the effects of a natural volcanic eruption, a nuclear war or an asteroid impact. Blocking sunlight this way serves the same purpose as using sunglasses to moderate the impact of harmful UV radiation on our eyes.

Billions of years later, when the Sun will brighten even more and eventually inflate to become a red giant that will engulf the Earth, there would be no option left for our civilization but to relocate its residence to a farther planet or moon in the Solar system. Since real estate is available only at specific locations and the Sun will change continuously, it would be prudent to manufacture a gigantic structure which will maneuver to the optimal orbital distance at any given time. Being able to adjust our distance from the “furnace” based on its changing brightness would be most helpful towards the end, when the solar remnant will dim considerably. For billions of years after the core of the Sun will turn into a white dwarf, the habitable zone will shrink by a factor of a hundred relative to the current Earth-Sun separation, down to a scale that is comparable to the size of the current Sun. Needless to say, the movable industrial complex of metal rods and equipment would represent a very major upgrade to our existing International Space Station. This artificial habitat for life may not look as beautiful as the plethora of green forests and blue oceans on Earth. But since humans needed merely 100,000 years to adapt to inhabiting an urban apartment complex in Manhattan from the wildlife of Africa, one can reasonably expect them to transition from Manhattan to living in space on a timescale that is ten thousand times longer.

Ultimately, we should contemplate space travel out of the Solar system. The longer-term solution to our existential threats is not to keep all of our eggs in one basket. We should make copies of what we hold dear and spread these copies to other stars in order to avoid the risk of annihilation from a single-point catastrophe. Our destinations could be habitable planets around nearby stars, such as Proxima b, or other desirable environments. The Breakthrough Starshot project represents the first well-funded initiative to traverse interstellar distances over a short time.

The transition to spreading multiple copies of our genetic material would resemble the revolution brought about by the printing press, when Gutenberg mass-produced copies of the Bible and distributed them throughout Europe. As soon as many copies were made, any
single copy lost its unique value as a precious entity. In the same way, as soon as we learn how to produce synthetic life in our laboratories, “Gutenberg-DNA printers” could be distributed to make copies of the human genome out of the raw materials on the surface of other planets so that any one copy will not be essential for preserving the information.

The reporter did not let me easily off the hook: “But what about our personal lives as individuals? Most people care about themselves. Your solution will not secure their personal safety so as to give them a peace of mind.”

My reply was simple. In our daily life, we worry about protecting our own “skin” because we are focused on timescales much shorter than our life span. But when dealing with timescales that are far longer than a century, it is not the individual that counts but rather the genetic information of the human species as a whole. The people we know right now will not be around within a century, so there is no reason to focus on preserving them individually when strategizing our future over a billion years. On such a long timescale, we better stay focused on preserving our species. The instinct of any parent is to care for the offspring and secure longevity this way; nature enabled us to extend the lifetime of our genome well beyond our own life span in this way. As an extension, modern science might enable us to construct printers that are capable of mass-producing copies of ourselves on other planets by merely exporting our genetic blueprint without requiring that our bodies will physically travel the distance. We should be satisfied with this renewed sense of security and retire happily when our mission is accomplished.

The reporter insisted: “But would we truly be satisfied if we will not be around to see it happening?” To which I replied: “Frankly, this may not matter. Perhaps we already are one copy out of many in existence, so it is not essential for this copy to survive. But after reading this morning’s newspaper - I am inclined to believe that our civilization will disappear as a result of self-inflicted wounds long before the Sun will pose its predictable threat. The dead silence we hear from numerous habitable exoplanets on the sky may indicate that advanced civilizations have much shorter lives than their host stars.”

ABOUT THE AUTHOR

Abraham Loeb
Abraham Loeb is chair of the astronomy department at Harvard University, founding director of Harvard’s Black Hole Initiative and director of the Institute for Theory and Computation at the Harvard-Smithsonian Center for Astrophysics. He also chairs the Board on Physics and Astronomy of the National Academies and the advisory board for the Breakthrough Starshot project.

(Credit: Nick Higgins)