

Status of *Breakthrough Starshot Initiative and Manifesto*

Breakthrough News

National Academy of Sciences Receives \$2.1 Million from *Breakthrough Prize Foundation* for Ongoing Support of Ukrainian-Led Scientific Research Projects [1]

August 10, 2023

The *Breakthrough Starshot* as part of the *Breakthrough Initiative* is a visionary project aimed at exploring other star systems and even reaching out to other galaxies.

Spearheaded by Russian physicist and entrepreneur *Yuri Milner*, the initiative was launched in 2016. It aims to develop the technology necessary to send spacecraft equipped with scientific instruments and cameras, on a journey to the nearest star system, the Proxima Centauri. [2]

Yuri Milner is a technology investor and science philanthropist.

Born in 1961, he was named after *Yuri Gagarin*, who earlier that year had become the first human to reach space — a moment of deep significance for humanity that would form part of the inspiration for his book ‘*Manifesto, the Mission for Our Civilization*’.

Yuri began his career as a theoretical physicist working in quantum field theory, but later changed fields and moved to the United States to study at the Wharton School of Business. After launching and developing a successful internet start-up, he went on to found DST Global, which has become one of the world’s most successful internet investment companies. Its portfolio has included some of the biggest technology brands like Facebook, Twitter, Alibaba and Spotify.

A lifelong fascination with science, and a conviction that the future of humanity depends on its flourishing, led *Yuri* and his wife *Julia* to join the *Giving Pledge*, Bill and Melinda Gates and Warren Buffet’s initiative whose members commit to donating half their wealth in their lifetime to philanthropic causes. *Yuri* and *Julia* have focused their donations on predominantly scientific programs. In 2012 they founded the *Breakthrough Prize*, a major annual science award, along with their co-founders *Sergei Brin*, *Priscilla Chan* and *Mark Zuckerberg*, and *Ann Wojcicki*. Three years later, *Yuri* partnered with *Stephen Hawking* to launch the *Breakthrough Initiatives*, a set of scientific programs searching for life and civilizations beyond our planet and developing the first practical technology for interstellar space flight. *Yuri* and *Julia*’s foundation has also supported various humanitarian causes, including medical equipment to protect against Covid-19. [3]

Manifesto

In 2021, *Yuri Milner* published some of his ideas in a book, *Eureka Manifesto: the Mission for Our Civilization*, ‘a book about humanity’s place in the Universe and our role in its future’.

The summary statement for the book reads:

“Any organization that is serious about doing something significant has a mission. But human civilization, as a whole, has nothing resembling a shared mission. In the long term, that means we cannot thrive— or probably even survive. But what could such a mission be? People, nations, and cultures vary wildly. Where on Earth do we look for a common goal?” [1]

Yuri Milner argues that we should look beyond Earth: in the universal story we are part of — and whose next chapters we can choose to write.

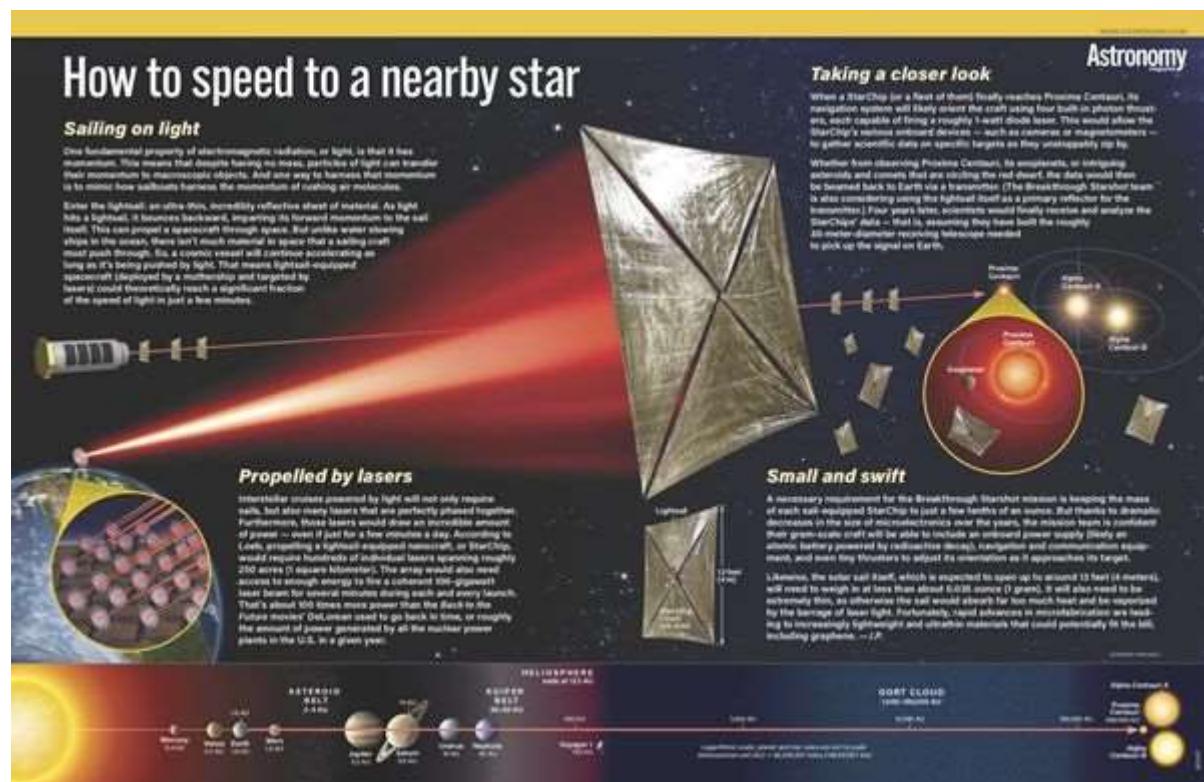
The 54-pages book is available online and can be downloaded at <https://yurimilnermanifesto.org/>

Breakthrough Starshot and supporting Initiatives

Starshot: As mentioned above, the Breakthrough Starshot is the final goal and aims to demonstrate proof of concept for ultra-fast light-driven nanocrafts, and lay the foundations for a first launch to *Alpha Centauri* within the next generation. Along the way, the project could generate important supplementary benefits to astronomy, including solar system exploration and detection of Earth-crossing asteroids.

Since Apollo 11's 'moonshot', we have been sending our machines ahead of us – to planets, comets, even interstellar space. But with current rocket propulsion technology, it would take tens or hundreds of millennia to reach our neighboring star system, Alpha Centauri. The stars, it seems, have set strict bounds on human destiny. Until now.

In the last decade and a half, rapid technological advances have opened up the possibility of light-powered space travel at a significant fraction of light speed. This involves a ground-based *light beamer* pushing ultra-light *nanocrafts* – miniature space probes attached to *lightsails* – to speeds of up to 100 million miles an hour. Such a system would allow a flyby mission to reach Alpha Centauri in just over 20 years from launch, beaming home images of its recently-discovered planet Proxima b, and any other planets that may lie in the system, as well as collecting other scientific data such as analysis of magnetic fields.



Breakthrough Starshot Overview (Graphic Roen Kelly) [4a]

Breakthrough Starshot aims to demonstrate proof of concept for ultra-fast light-driven nanocrafts, and lay the foundations for a first launch to Alpha Centauri within the next generation. Along the way, the project could generate important supplementary benefits to astronomy, including solar system exploration and detection of Earth-crossing asteroids.

A number of hard engineering challenges remain to be solved before these missions can become a reality. They are listed on the Breakthrough Initiatives webpage [4], for consideration by experts and

public alike, as part of the initiative's commitment to full transparency and open access. The initiative will also establish a research grant program, and will make available other funding to support relevant scientific and engineering research and development. [4]

The other Breakthrough Initiatives supporting the Breakthrough Starshot initiative, are:

Listen: Breakthrough Listen is the largest ever scientific research program aimed at finding evidence of civilizations beyond Earth. The scope and power of the search are on an unprecedented scale.

Watch: Breakthrough Watch aims to identify and characterize Earth-sized, rocky planets around Alpha Centauri and other stars within 20 light years of Earth, in search of oxygen and other "biosignatures". Half a millennium after Galileo, the discovery of life would once again revolutionize our perspective on the Universe.

Message: Breakthrough Message aims to encourage debate about how and what to communicate with possible intelligent beings beyond earth. It takes the form of an international competition to create messages that could be read by an advanced civilization. The message must be in digital format, and should be representative of humanity and planet Earth.

Discuss: Breakthrough Discuss is an annual academic conference focused on life in the Universe and novel ideas for space exploration. Annual conferences started in 2016 and were held every year. The actual Breakthrough Discuss Conference one was held on June 28-29, 2023 at UC Santa Cruz, CA. [9]

Prize: The Breakthrough Prize, renowned as the "Oscars of Science", recognizes the world's top scientists working in the fundamental sciences – the disciplines that ask the biggest questions and find the deepest explanations.

Each prize is \$3 million and presented in the fields of Life Sciences, Fundamental Physics and Mathematics. In addition, the New Horizons in Physics and Mathematics Prizes and the Maryam Mirzakhani New Frontiers Prize are awarded to early-career researchers.



April 17, 2023, 9th Breakthrough Prize Ceremony, Hollywood, L.A. CA
Awardees are recognized onstage. / Photograph courtesy of Bob Riha with CZI [10]

Conclusion

The Breakthrough Starshot Initiative is an incredible and ambitious project. It has the potential to revolutionize human capabilities to reach out to the stars and stimulate technological innovation. Despite the various hurdles, it is hoped that the project will pave the way for a new era of human space exploration. [5]

Current Research

On June 23, 2016 a number of prototype “Sprites” – the world’s smallest fully functional space probes, built on a single circuit board – achieved Low Earth Orbit, piggybacking on OHB System AG’s ‘Max Valier’ and Latvia’s ‘Venta’ satellites. The 3.5-by-3.5 centimeter chips weigh just four grams but contain solar panels, computers, sensors, and communications equipment. These vehicles are the next step of a revolution in spacecraft miniaturization that can contribute to the development of centimeter- and gram-scale “StarChips” envisioned by the Breakthrough Starshot project. [6]

Then in 2019, the initiative sent another tiny prototype some 100,000 feet (30,500 m) above Earth to snap pictures of our planet’s surface. The test captured some 4,000 shots during its flight, spawning much discussion about what equivalent images of the two known exoplanets around Proxima Centauri might look like. [7]

According to Breakthrough News [8] announcements the emphasis in the years 2020-2023 have been focused on *Breakthrough Listen*, *Breakthrough Watch* and *Breakthrough Discuss*. Conferences are held annually and Breakthrough prizes are awarded on a yearly basis, except in 2019-2022.

It should also be mentioned that the Breakthrough Prize Foundation is supporting Russian Ukrainian conflict victims and Ukrainian scientists with donations since 2022.

References

- [1] News 2023, <https://breakthroughprize.org>
- [2] <https://www.tomorrow.bio/post/what-is-the-breakthrough-starshot-initiative-2023-06-4603037505-space>
- [3] Manifesto, <https://yurimilnermanifesto.org/>
- [4a] <https://www.astronomy.com/science/breakthrough-starshot-a-voyage-to-the-stars-within-our-lifetimes/>
- [4] <https://breakthroughinitiatives.org/initiative/3>
- [5] <https://www.tomorrow.bio/post/what-is-the-breakthrough-starshot-initiative-2023-06-4603037505-space>
- [6] [Breakthrough Initiatives](#)
- [7] <https://www.astronomy.com/science/breakthrough-starshot-a-voyage-to-the-stars-within-our-lifetimes/>
- [8] <https://breakthroughinitiatives.org/news>
- [9] Breakthrough Discuss, <https://breakthroughinitiatives.org/initiative/5/discuss>
- [10] CZI, <https://chanzuckerberg.com/newsroom/9th-annual-breakthrough-prize-honors-renowned-scientists/>