Photonics advances allow Earth to be seen across the universe

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Credit: Istock Photo

Looking up at the night sky—expansive and seemingly endless, stars and constellations blinking and glimmering like jewels just out of reach—it's impossible not to wonder: Are we alone?

For many of us, the notion of intelligent life on other planets is as

captivating as ideas come. Maybe in some other star system, maybe a billion light years away, there's a civilization like ours asking the exact same question.

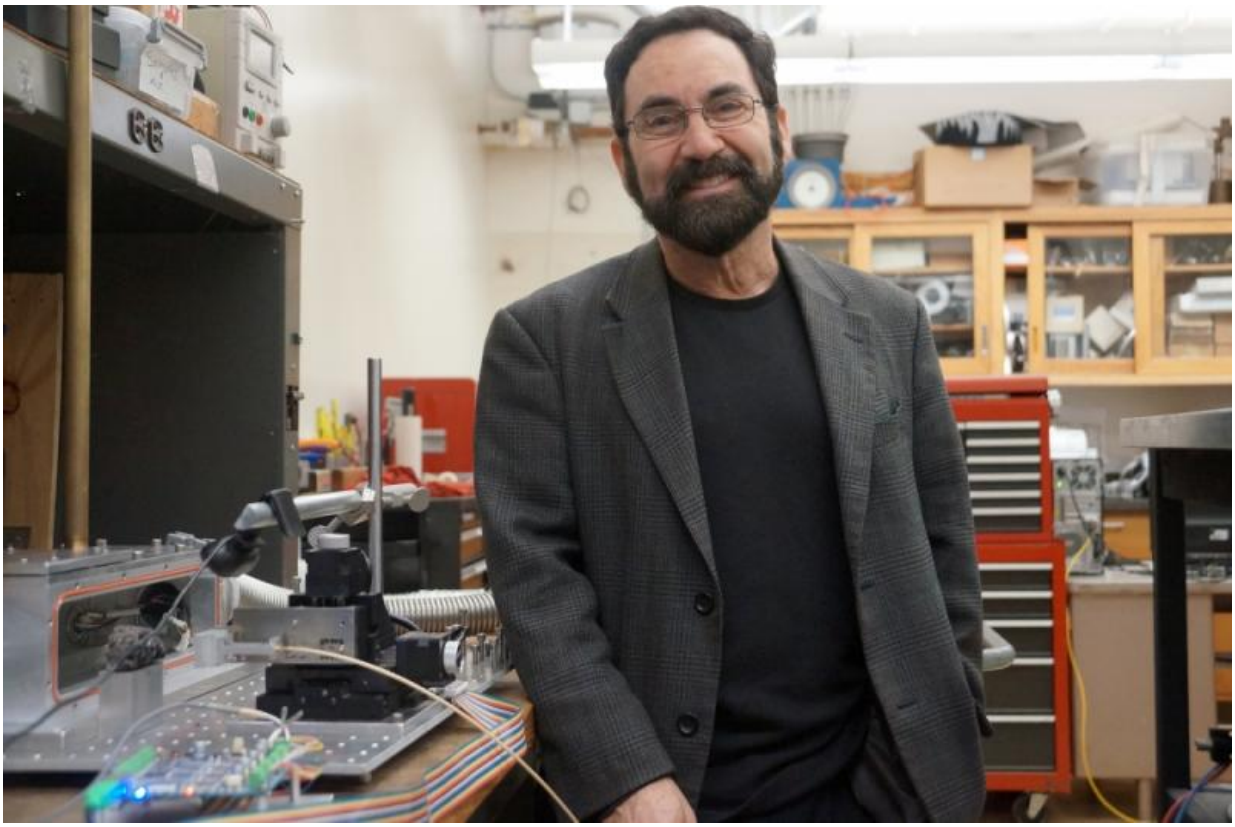
Imagine if we sent up a visible signal that could eventually be seen across the entire universe. Imagine if another civilization did the same.

The technology now exists to enable exactly that scenario, according to UC Santa Barbara physics professor Philip Lubin, whose new work applies his research and advances in directed-energy systems to the search for extraterrestrial intelligence (SETI). His recent paper "The Search for Directed Intelligence" appears in the journal *REACH – Reviews in Human Space Exploration*.

"If even one other civilization existed in our galaxy and had a similar or more advanced level of directed-energy technology, we could detect 'them' anywhere in our galaxy with a very modest detection approach," said Lubin, who leads the UCSB Experimental Cosmology Group. "If we scale it up as we're doing with direct energy systems, how far could we detect a civilization equivalent to ours? The answer becomes that the entire universe is now open to us.

"Similar to the use of directed energy for relativistic interstellar probes and planetary defense that we have been developing, take that same technology and ask yourself, 'What are consequences of that technology in terms of us being detectable by another 'us' in some other part of the universe?'" Lubin added. "Could we see each other? Can we behave as a lighthouse, or a beacon, and project our presence to some other civilization somewhere else in the universe? The profound consequences are, of course, 'Where are they?' Perhaps they are shy like us and do not want to be seen, or they don't transmit in a way we can detect, or perhaps 'they' do not exist."

The same directed energy technology is at the core of Lubin's recent efforts to develop miniscule, laser-powered interstellar spacecraft. That work, funded since 2015 by NASA (and just selected by the space agency for "Phase II" support) is the technology behind billionaire Yuri Milner's newsmaking, $100-million Breakthrough Starshot initiative announced April 12.



Philip Lubin. Credit: Sonia Fernandez

Lubin is a scientific advisor on Starshot, which is using his NASA research as a roadmap as it seeks to send tiny spacecraft to nearby star systems.

In describing directed energy, Lubin likened the process to using the force of water from a garden hose to push a ball forward. Using a laser light, spacecraft can be pushed and steered in much the same way. Applied to SETI, he said, the directed energy system could be deployed to send a targeted signal to other planetary systems.

"In our paper, we propose a search strategy that will observe nearly 100 billion planets, allowing us to test our hypothesis that other similarly or more advanced civilizations with this same broadcast capability exist," Lubin said.

"As a species we are evolving rapidly in photonics, the production and manipulation of light," he explained. "Our recent paper explores the hypothesis: We now have the ability to produce light extremely efficiently, and perhaps other species might also have that ability. And if so, then what would be the implications of that? This paper explores the 'if so, then what?'"

Traditionally and still, Lubin said, the "mainstay of the SETI community" has been to conduct searches via radio waves. Think Jodie Foster in "Contact," receiving an extraterrestrial signal by way of a massive and powerful radio telescope. With Lubin's UCSB-developed photonics approach, however, making "contact" could be much simpler: Take the right pictures and see if any distant systems are beaconing us.

"All discussions of SETI have to have a significant level of, maybe not humor, but at least hubris as to what makes reason and what doesn't," Lubin said. "Maybe we are alone in terms of our technological capability. Maybe all that's out there is bacteria or viruses. We have no idea because we've never found life outside of our Earth.

"But suppose there is a civilization like ours and suppose—unlike us, who are skittish about broadcasting our presence—they think it's

important to be a beacon, an interstellar or extragalactic lighthouse of sorts," he added. "There is a photonics revolution going on on Earth that enables this specific kind of transmission of information via visible or near-infrared light of high intensity. And you don't need a large telescope to begin these searches. You could detect a presence like our current civilization anywhere in our galaxy, where there are 100 billion possible planets, with something in your backyard. Put in context, and we would love to have people really think about this: You can literally go out with your camera from Costco, take pictures of the sky, and if you knew what you were doing you could mount a SETI search in your backyard. The lighthouse is that bright."

More information: The Search for Directed Intelligence. Philip Lubin, 2016, *REACH - Reviews in Human Space Exploration*, arxiv.org/abs/1604.02108

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