

■ by JENNIE ROTHENBERG GRITZ

illustration by TIM O'BRIEN

The Wonder *of* Avi Loeb

**The physicist thinks we might
have glimpsed evidence of
an alien civilization. Despite
controversy, he's determined
to find more**





ABRAHAM LOEB KNOWS how improbable it is that he's here. First, there had to be a Big Bang. Stars had to form, and planets. On one particular planet (and no one really knows how) single-celled organisms had to appear and evolve into complex creatures. One species of primate had to learn to speak and write and invent technology. And in 1936, Loeb's grandfather had to have the foresight to leave Germany, making his branch of the family tree the only one to survive.

Now the Israeli-born astrophysicist, whom everyone calls Avi, is sitting on his porch in Lexington, Massachusetts, watching birds flutter around a feeder. He's 59 years old, the Frank B. Baird Jr. Professor of Science at Harvard University, wearing a black blazer and black polo shirt. His eyes are blue behind rimless glasses, and his wide-awake face seems to emit its own light.

Loeb started out at Princeton in the late 1980s, studying the birth of the first stars. Harvard recruited him in 1993, and in 2011 he became the chair of the astronomy department, a position he held for nine years. Since 2007, he has directed Harvard's Institute for Theory and Computation (which is part of the Center for Astrophysics, Harvard & Smithsonian). He has published more than 700 papers and essays, making major contributions to the study of black holes and to gravitational microlensing, a technique for detecting objects that are shrouded in darkness all throughout the observable universe.

But a few years ago, the trajectory of his well-established career took a dramatic turn. In October 2017, the University of Hawaii's Pan-STARRS1 telescope caught the first-ever glimpse of an object from outside our own solar system whizzing past the Sun. They observed it for a few weeks until it disappeared from view, and named it 'Oumuamua, a Hawaiian word that means "messenger from afar arriving first." The sighting was especially dramatic because the object behaved in baffling ways. It accelerated suddenly without leaving any visible trail, and reflected sunlight indicated that it was flat like a pancake. It was unlike anything astronomy had ever seen.

Scientists proposed various theories in scientific journals. Maybe 'Oumuamua was a piece of a Pluto-like planet ejected



↑ An artist's rendering of 'Oumuamua. Astronomers calculated the far-off object's unusual shape based on the ways it brightened and dimmed as it rotated.

from another arm of the Milky Way galaxy. Maybe it was a dust cloud with an ultra-low density, held together by forces scientists couldn't understand. Maybe it was a hydrogen iceberg. Loeb suggested something completely different: Maybe 'Oumuamua was a light-powered sail manufactured by aliens.

It was an astonishing idea coming from the chair of Harvard's astronomy department. This was a man who, just a year earlier, had launched Harvard's prestigious Black Hole Initiative, the world's first interdisciplinary program to focus on black holes. The legendary Stephen Hawking had flown across the Atlantic for the occasion, attending a Passover Seder at Loeb's home during his visit. No one expected someone of Loeb's stature to make such a sugges-

“The greatest gift of being a scientist is that you get to wonder and take risks.”

tion, and some of his colleagues wished he hadn't.

“When we first discovered 'Oumuamua, of course we joked, ‘Could it be alien technology?’” says Karen Meech, the interim director for astrobiology and solar system bodies at the University of Hawaii, and part of the team that collected the data. “We laughingly called it Rama for a while,” she adds, a reference to the interstellar starship in the 1973 Arthur C. Clarke novel *Rendezvous With Rama*. “It was a hard experiment, because the object was moving rapidly away from us. But still, we know there are comets and asteroids that share some characteristics

with 'Oumuamua. So why would you go to the most extreme explanation and assume it's aliens? You still need to follow the scientific process, and I wish Avi had done more of that.”

But Loeb was struck by all the ways 'Oumuamua did not behave like a typical comet or asteroid. He discussed those anomalies in his book *Extraterrestrial: The First Sign of Intelligent Life Beyond Earth*, published at the beginning of this year. Despite the bold implications of its subtitle, the book itself made no definitive claims about the identity or origin of 'Oumuamua, but Loeb argued that science

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should be embracing the novelty of the object and that the search for extraterrestrials shouldn't be trivialized. In June, Loeb published another book about extraterrestrials, *Life in the Cosmos: From Biosignatures to Technosignatures*, a highly technical tome co-authored with astrobiologist Manasvi Lingam and intended as a university textbook.

"The greatest gift of being a scientist is that you get to wonder and take risks," Loeb told me. "When kids see a new object, they're curious. They play with it, turn the object, learn how the object behaves. Whereas an adult can look at the object from far away, from just one direction, and say, 'I don't need to go over there and look more closely. I've seen objects like this before. I already pretty much know what it looks like from the other side.' But maybe the other side looks completely different from what you'd expect. The way to gain new knowledge is to pay special attention to things that don't line up."

The public was delighted to see an eminent professor writing about aliens. ("Let This Harvard Professor Convince You That Aliens Exist," a *New York* magazine headline proclaimed.) He got a fresh wave of attention after the Office of the Director of National Intelligence released a report in June, "Preliminary Assessment: Unidentified Aerial Phenomena," which was based on 144 sightings by military pilots—things that hadn't reacted to the wind in expected ways, or had moved abruptly for no obvi-



Loeb sat in on some of her philosophy classes and read the books she was reading.

ous reason. The report acknowledged that its findings were "largely inconclusive." In early July, donors started approaching Loeb, offering him \$1.7 million to look for new evidence that would be more conclusive.

So Loeb started an endeavor called the Galileo Project. He and his colleagues would monitor the skies, using arrays of their own telescopes as well as data from large observatories. Artificial intelligence would help the scientists sift through the images and figure out whether, as Loeb puts it, an object was "Made in Country X" or "Made on Exoplanet Y." And unlike the government, which keeps such information classified and releases selected details only now and then, the Galileo Project would make all its findings continuously available to the public.

Seven-year-old Loeb on his family's farm. "The science I do is connected by a direct line to my childhood," he writes in *Extraterrestrial*. "It was an innocent time of wondering about the big questions in life."

"Avi is obviously a very out-of-the-box thinker," says Princeton astrophysicist Edwin Turner, a long-time collaborator of Loeb's. "In science, we're taught to be conservative and skeptical in many ways. That's crucial when you're designing experiments and interpreting data. But that mind-set can hold scientists back when it makes them reject any new hypothesis that doesn't seem consistent with everything we knew before. You want to be critical in your methodology but unfettered in your imagination."

By naming his project after Galileo, Loeb is making a statement about what it means to challenge the status quo. After the Italian scientist was branded as a heretic in the 17th century for suggesting that Earth moves around the Sun, priests forced him to



Loeb at age 2, with his mother, Sara. After surviving World War II in her native Bulgaria, Sara moved to Israel in 1948. She and Loeb's father met at a farming community and raised their three children there.



COURTESY THE LOEB FAMILY (2); WEBB CHAPPELL

recant. But Galileo reportedly couldn't resist adding under his breath, "And yet it moves."

For his part, Loeb has no intention of apologizing for his interest in extraterrestrials. In fact, he's just getting started.



ASTRONOMERS SPEND THEIR LIVES making awe-inspiring discoveries, the kind that can lead to gorgeous documentaries with cello soundtracks. They also tend to be territorial, which is true of other researchers, but there's something unique about the way this plays out in a field where the territories are cosmic in scale and so much is still entirely unknown.

Loeb today, holding the gold pocket watch that belonged to his German grandfather, Albert, who fled to Israel in the 1930s. The front of the watch is engraved with the initials both Loeb's share.

Some astronomers specialize in small bodies like comets and asteroids, and for them, 'Oumuamua was life-changing: It was the first object humans had ever seen that formed in another solar system and entered our own. "Talk to anybody who worked on it. It was the most exciting discovery of the last 20 years," says Darryl Seligman, a postdoctoral fellow at the University of Chicago. "Just detecting an interstellar comet would've been a huge deal, but the fact that it was a complete mystery in every single way made it way more exciting. It's almost never the case that you discover the first of something and then, in every way that you would expect it to behave, it acts the exact opposite."

The oddness of 'Oumuamua became even more pronounced in 2019, when scientists made the second-ever observation of an interstellar object. This time, everyone agreed that the novel object—known as 2I/Borisov—was a type of comet: It generated a trail of evaporated gas and dust as it passed close to the Sun. Why, then, had 'Oumuamua acted so differently?

Experts put out competing theories. Seligman and his doctoral adviser, Gregory Laughlin, a professor of astronomy at Yale, made a compelling case that 'Oumuamua was composed of molecular hydrogen ice. Steve Desch, an astrophysicist at Arizona State University, argued that it was a piece of a Pluto-like planet that had been ejected from the Perseus arm of the Milky Way galaxy some 400 million or 500 million years ago. Three scientists at the University of Oslo, led by Jane X. Luu, proposed what they called a "dust-bunny model," envisioning 'Oumuamua as a low-density fractal body that formed in the envelope of gases and particles surrounding a comet. Some of the disagreements have been cordial and

others less so. But there's still no consensus, which leaves room for a voice offstage to keep chiming in that 'Oumuamua could be an alien light sail.

I mentioned Loeb to scientists who've been studying 'Oumuamua. One chuckled a long time before saying, "I get along with Avi, but..." Others complained he's saying outrageous things just to get attention. Some refused to even acknowledge his contributions in any other area: When I brought up the Black Hole Initiative, one especially indignant astronomer retorted, "I'm a planetary scientist, so I wouldn't know of his previous work."

In May, Desch, who had already disputed Loeb's theory about 'Oumuamua, openly criticized another one of Loeb's ideas. This time, Loeb and Harvard

student Amir Siraj had weighed in on what killed the dinosaurs 66 million years ago. The widely accepted theory is that the dinosaurs perished after Earth was struck by an asteroid, which is composed of rocks and metals. Loeb and Siraj argued that the culprit was a comet, a smaller celestial body made of rocks, dust and ice. Desch and his three co-authors sharply critiqued Loeb and Siraj's argument on scientific grounds and then went on to scold Loeb for wandering, once again, into an area outside of his expertise. "Often there are differences in scientific culture between fields about how they deal with uncertainty, or what constitutes a burden of proof," Desch and his collaborators wrote. "It is possible and rewarding to engage in interdisciplinary research, but it starts with opening dialogs with researchers in other fields, based on mutual respect and a lot of listening." Loeb and Siraj responded to the technical criticisms but said nothing about the scolding.

Some astronomers are more irked by the way Loeb often delivers his ideas, with an enthusiastic directness that can read as impatience. In February, Loeb had a tense exchange with Jill Tarter, the scientist who inspired the lead character in Carl Sagan's 1985 novel *Contact*. Tarter helped establish a field called SETI, which stands for the search for extraterrestrial intelligence. At a Zoom event, Loeb argued vehemently that extraterrestrial research deserves more funding and attention. Tarter felt he was overlooking the decades she'd spent lobbying for that kind of support. Afterward, Loeb emailed Tarter and apologized for his tone, adding: "I realize that I should have said that I greatly appreciate your past contributions to promoting this cause and I am delighted to join forces with you and push the envelope further."

Tarter declined to be interviewed, directing me instead to Seth Shostak, a senior scientist at the SETI Institute. "I don't think Avi is right about 'Oumuamua,'" Shostak told me. "We've got people here who study asteroids and they say there's nothing to suggest it wasn't a naturally occurring object. If some guy from Bismarck, North Dakota, whom no one had ever heard of, was saying what Avi is saying, people would respond, 'Come on, it's just an asteroid.' But this is a Harvard astronomer who was the chair of the department, clearly a very bright

guy. So you sort of have to take him seriously."

The SETI Institute is funded by private donations, but that wasn't always the case. Back in the 1960s, when radio technology and space travel were advancing rapidly, it seemed plausible that humans might be ready to find other intelligent beings. The American astrophysicist Carl Sagan and his Russian colleague Iosif Shklovsky made a scientific case for this prospect in their 1966 book, *Intelligent Life in the Universe*. NASA gave funding to SETI-related projects from the 1970s until 1993, when Nevada Senator Richard Bryan introduced a budget amendment that killed the program. "As of today," Bryan argued in a widely quoted statement, "millions have been spent and we have yet to bag a single little green fellow."

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Joining Loeb in 2016 to inaugurate the Black Hole Initiative, Hawking told the audience, "Black holes are stranger than anything dreamed up by science fiction writers."



▶ Unlike Loeb, who blames science fiction for making the search for extraterrestrials seem unserious, Shostak makes playful references to "finding E.T." and even appeared in a "Star Trek" video. But his actual research is cautious and methodical. He and his colleagues at the SETI Institute haven't announced any extraterrestrial discoveries yet, but he notes that their equipment is getting better all the time. In the 1960s, the astronomer Frank Drake searched the airwaves for alien transmissions using a single-channel radio receiver. Today, Shostak and his colleagues are using 72 million channels, each one listening to its own small slice of the radio dial (1 Hz). As the number of channels keeps growing, SETI researchers hope they'll be able to speed up their search.

Loeb has a different approach: Instead of radio broadcasts, he's looking for physical artifacts and

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Loeb on "CBS This Morning" in February 2021, shortly after his book *Extraterrestrial* debuted at Number 7 on the *New York Times* best-seller list.

▶
Pan-STARRS1, the telescope that first spotted 'Oumuamua. Scientists also use Pan-STARRS1 to search for asteroids that could threaten Earth.

ROB MASSEY / PULSE MEDIA



chemical byproducts of alien technology. But he and Shostak both think their approaches could be complementary. Loeb is eager for the opening of the Vera C. Rubin Observatory in Chile in 2023. Its digital camera will have the highest resolution of any ever invented (over three billion pixels), and it will take nearly continuous photos of 20 billion galaxies. Each individual photo will cover an area as large as 40 moons. The observatory will vastly expand the field Loeb likes to call space archaeology.

Because the search for extraterrestrials involves such unorthodox thinking, it might necessitate jumping across well-established lines. "Most scientists are incredibly narrow," says Sara Seager, an MIT astrophysicist and MacArthur Fellow who innovated a groundbreaking method for studying the atmospheres of far-off planets. "But like Avi, I work really broadly. If something interests me, I just go for it."

"An empirical test is a dialogue with nature. You have to listen to see if nature confirms your ideas."



COURTESY THE LOEB FAMILY; ROB RATKOWSKI / PSISC



avorites were the French existentialists like Jean-Paul Sartre and Albert Camus.

Loeb is secular in the way many Israelis are. He celebrates Jewish holidays and sees the Bible as a record of how his ancestors thought. They, too, were interested in the origins of the stars. Loeb envisions a space-age version of Noah's Ark. "You don't want to board elephants and whales and birds, because it's very cumbersome to lift them into space," he says. "All you need is the DNA. You can put it on a computer with artificial intelligence and a 3-D printer such that you can reproduce it."

When Loeb talks this way, he sounds like a philosopher doing a thought experiment. This is one way to understand his outspokenness on 'Oumuamua—he's urging the scientific community to consider that a novel object like 'Oumuamua *could* be alien technology. But what makes Loeb a scientist is he's ultimately pushing for evidence. If 'Oumuamua turns out to have been a hydrogen iceberg, Loeb says he'll be fine with that. "In that case, we need to look for other hydrogen icebergs, because that means there are nurseries making objects we've never seen before," he says. "This is not a philosophical question. My point is that this should intrigue us to collect more data."

Loeb became an astronomer almost by accident. In 1980, based on his strong test scores in high school, the Israeli military asked him to apply for Talpiot, an elite program for developing new defense technologies. Each year, Talpiot puts a small class

Loeb ended up meeting the legendary physicist Freeman Dyson at Princeton. Like everyone else, Dyson was impressed by the young scientist, and suggested he speak with John Bahcall, a Princeton astrophysicist, who invited Loeb to join him for postdoctoral research. Loeb knew nothing about astronomy at the time, but Bahcall's gamble paid off.

Today, Loeb thinks of his relationship with astronomy as an arranged marriage that worked. Unlike philosophy, which allows thinkers to spend their lives floating in the realm of big ideas, science ultimately demands concrete proof. Even Einstein's widely accepted theory of general relativity was confirmed only a century later, when scientists detected the first gravitational waves and took the first picture of a black hole. "An empirical test is a dialogue with nature," Loeb says. "You have to listen to see if nature confirms your ideas. You can think of it like Bernie Madoff. He proposed a beautiful idea. He told people, 'Give me your money. I'll give you more in return, irrespective of what the stock market does.' Everyone was happy—until they did the experimental test where they said, 'Give us back the money.' Then he was put in jail. So why is an experimental test necessary? To find Ponzi schemes!"

Loeb's actual marriage, to Ofrit Liviatan, started with a blind date in Tel Aviv in 1997. Loeb returned to Harvard and Liviatan eventually joined him there, as a lecturer on law and politics in the government department. In 2005, the couple and their daughters, Lotem and Klil, moved to Lexington, to the kind of leafy neighborhood where you'd expect pro-

Seager and her collaborators are trying to figure out which planets have basic building blocks for life as we know it—water, for instance. "If we can establish that, it's like baby steps, right?" she says. But even though her own approach is more incremental, she sees no reason that Loeb should be discouraged from looking for signs of alien civilizations. "The way I think of it is—why not?" she told me. "Why wouldn't you look for that? If it's relatively straightforward, why not try it?"



ONE OF THE ARTIFACTS Loeb keeps from his own family's history, stored inside its original box, is an initialed pocket watch that belonged to his grandfather, Albert Loeb. The Loeb family lived in Germany for 700 years, and Albert won a medal for his service during World War I. Today, there's a street in his central German hometown called Albert Loeb Way. But

▲ Loeb in his home office. Among the treasures he keeps there is a slim Hebrew-language book of his essays, including teenage philosophical notes unearthed by his mother.

in 1933, Albert went to a meeting at the town square and heard a local Nazi Party member blame the Jews for Germany's struggles. Albert pointed out that he'd served on the German front during the war. "We all know about your patriotic contributions, Mr. Loeb," the Nazi replied. "I was talking about the other Jews." Loeb threw away his medal and, in 1936, moved with his wife and children to British-controlled Palestine. His other relatives stayed to see if the situation would improve. None of them made it out alive.

By the time Avi was born in 1962, his father, David, was a pecan farmer on a *moshav*, a cooperative farming community. His mother, Sara, had abandoned her education when she left Bulgaria in the 1940s, but she nurtured a rich life of the mind for herself and her children. When Loeb was a teenager, she started working toward a PhD in comparative literature. Loeb sat in on some of his mother's philosophy classes and read the books she was reading. His fa-

"He told us about his research and made sure we stayed curious in the same way."

of recruits (originally 25, now 50) through three years of science education as they undergo grueling physical training. Loeb was such a standout that instead of serving in a combat unit, as Talpiot graduates generally do, he was allowed to earn a PhD in physics at Hebrew University. When he was still in his early 20s, the leaders of President Ronald Reagan's Strategic Defense Initiative (known colloquially as the "Star Wars" program) invited Loeb to Washington, D.C. to present a new method for propelling high-speed projectiles. The U.S. officials listened to Loeb and then put his ideas into practice. "They just followed my theoretical research, and they scaled it, and it worked," he says.

fessors to live. Their dinner conversations were fascinating, says Klil, now a junior at the University of Massachusetts Amherst. "My dad is always super fun and energetic," she told me. "He told us about his research and made sure we stayed curious in the same way."

Loeb's home office is piled high with copies of *Extraterrestrial* in different languages. One wall has a painting of a dove flying around a

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planet. On a shelf in front of the painting are a menorah and a replica of Auguste Rodin's *The Thinker*, side by side as though in an ongoing conversation. When Loeb needs even more solitude, he heads to his backyard. There's a quiet area surrounded by trees, with no other homes in sight. "This space has been really formative for me," he says. "It gives me the psychological sense of not having any neighbors, of just being open."

As a nature-loving farm boy who idolized his mother, Loeb felt like a misfit among Israeli men. He proudly notes that he was a high school athlete and excelled at the physical challenges of military training. But the hard-nosed masculinity Loeb saw growing up never suited his dreamy temperament. These days, he feels like an outlier in a different way. You'd expect more astronomers to be philosophical thinkers, but it's a field where people tend to prove themselves by specializing rather than expanding.

Loeb thinks some of the best-funded areas are more arcane than the search for aliens. Take dark matter. Turner, the Princeton astronomer, says when he was at Caltech in the 1970s, no one believed in dark matter. "I did my PhD thesis expecting to prove dark matter wasn't there, because that's what my professors told me," Turner says.

Now, though, the search for dark matter is at the forefront of astronomy. At a conference a few years ago, Loeb listened to a colleague discuss the theory that dark matter is made of weakly interacting massive particles—known as WIMPs—even though such particles have yet to be found. During the question-and-answer session, Loeb asked, "How long will you continue to work on something that apparently doesn't exist?" The speaker replied, "As long as I'm funded." Retell-



▲ Two different approaches to finding extraterrestrials: Top, Shostak, of the SETI Institute, scans radio waves for alien broadcasts. Above, MIT's Seager looks for compounds that could support life on other planets.

▼ Amir Siraj, a college undergrad and a scientific collaborator of Loeb's, in Switzerland for a June 2021 piano concert he performed.

ing that story, Loeb concludes, "In principle, he could spend his entire career searching for a ghost."

But there are ghosts, and then there are aliens. One reason dark matter is such a focus is that *something* invisible makes up a huge portion of the known universe, and identifying it would revolutionize our understanding of physics. Loeb acknowledges this, but he points out that such a discovery, while momentous, would have little impact on everyday people. "You could walk up to someone on the street and say, 'Dark matter is a WIMP.' They'd say, 'Okay. So what?'" But if we found any relic or signature of a technological civilization, that would have a huge impact on the way we see our place in the universe and our relationships with each other."

It's hard to predict, though, just what the impact would be. Former President Barack Obama recently told *New York Times* writer Ezra Klein, "I would hope that the knowledge that there were aliens out there would solidify people's sense that what we have in common is a little more important." But he added, "No doubt, there would be immediate arguments about, well, we need to spend a lot more money on weapons systems to defend ourselves. And new religions would pop up, and who knows what kind of arguments we'd get into."

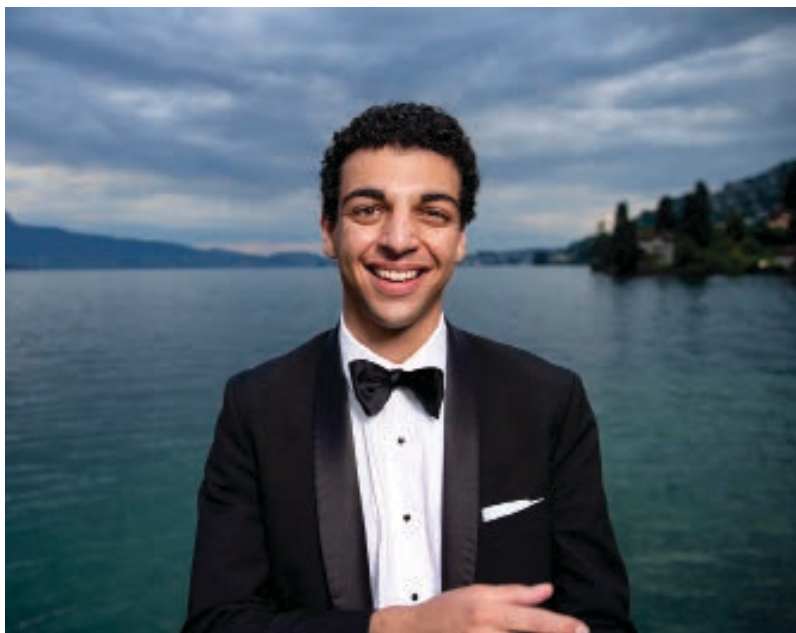
Loeb comes from a part of the world where people are locked in violent and seemingly endless ideological struggles. But he imagines bridging even larger divides by discovering an alien version of existential philosophy. He hopes we'll find records from a civilization more intelligent than our own.

On the other hand, we might find remnants of a species that met a grim fate. In 1988, the economist Robin Hanson wrote a paper called "The Great Filter," listing the hurdles an extraterrestrial species would have to overcome to get to the point where we could communicate with it. Basic organic molecules like RNA would have to emerge (an enormous step, since no one has any idea how this happened on Earth). Single-celled organisms would have to evolve into something like animals. Finally, a species would have to become advanced enough to colonize space without using technology to obliterate itself.

"If we found a species that had destroyed its own planet, it would be like looking into our own future," Loeb says. Discovering mistakes made by aliens might inspire us to do better.



ON A MONDAY MORNING in late July, Loeb launched the Galileo Project at an online press conference. He explained how the project—whose funders include a Silicon Valley investor, a Los Angeles



COURTESY DR. SETH SHOSTAK; JUSTIN KNIGHT; VALENTIN LUTHIGER / SWISS ALPS CLASSICS

real estate broker and the CEO of a Wisconsin-based biotech firm—will set up megapixel telescopes that can capture nearby objects and phenomena in high resolution. (The telescopes Loeb currently has in mind can be purchased off the shelf for roughly half a million dollars each.) The project will also develop new software to rule out false positives and reduce false negatives, making it clearer whether or not an object or a transient event has natural origins. Once the scientists have access to data from the Vera C. Rubin Observatory, Loeb said, they might spot an object like ‘Oumuamua as often as once a month.

He turned the screen over to Frank Laukien, the Galileo Project’s co-founder, a visiting scholar at Harvard’s department of chemistry and chemical biology and the CEO of the Bruker Corporation, which designs scientific instruments. Laukien noted that his Zoom

parent. Laukien invoked Galileo, who invited doubters to look through his telescope. The Galileo Project was extending a similar invitation—to take “an agnostic, scientific look through the telescope” and see whatever there is to see.

The project’s team includes astronomers, computer scientists and experts on observational instruments. Its youngest member is Amir Siraj, a 21-year-old Harvard undergraduate who was Loeb’s co-author on the dinosaur paper. Siraj has been working with various Harvard astronomers since he was in high school, but Loeb has become his mentor.

“I’ve been surprised by how negative the scientific community can be, the things they’re willing to say in emails and on Twitter, even to super-early-career people like myself,” Siraj told me, sitting in a Boston coffee shop. “The level of vitriol can be like a middle-school playground.” In contrast, he said, “Avi actually *likes* it when people disagree with him! It’s because he’s really interested in learning.”

Siraj’s mother was born in Iran and left the country with her sister at 16 while their parents were in Tehran on house arrest. His father was

born in Lebanon, the son of a Saudi diplomat. The two met as Harvard graduate students. Siraj, their youngest of three, is enrolled in a joint program between Harvard and the New England Conservatory, simultaneously studying piano and astrophysics. This summer, he traveled to Lake Lucerne to play the opening concert for the Swiss Alps Classics series.

“Music and physics felt like two sides of the same coin from the get-go,” he says. Once, he was stumped by an astronomy problem and sat down to play Bach. As the two parts in the counterpoint circled each other, he had the idea that our sun might have once had a twin star. He ended up publishing an article in *Astrophysical Journal Letters* called “The Case for an Early Solar Binary Companion,” co-authored with Loeb.

Siraj thinks finding extraterrestrial intelligence could bring humanity together. “In the short term, there might be grabs for authority, but I just feel like it would be something so big and unifying,” he says. “And that’s how I feel working with Avi. It’s this sense of shared curiosity. Nature has provided us with such wonderful things, if only we could focus on those a bit more.”

If these two Middle Easterners had their way, people all over the world would set aside their differences and search for intelligent life among the distant stars. In the process, humanity would figure out how to avoid destroying our own planet and find our place in something larger than we’d ever imagined.

Is it far-fetched? Very. But no more than dark matter or the Big Bang. No more than Earth developing the perfect conditions for life to evolve and thrive. No more than so many other extraordinary things, known and still unknown, that have happened in the 13 billion-year history of this immense universe. ♦



▲ A Loeb family Thanksgiving, 2020: Avi and Ofrit flanked by daughters Lotem, left, and Klil, right. Klil says her dad is “trying to figure out every answer that he can in his lifetime.”

background was a picture of the northern lights—once an unexplained phenomenon, until physicists figured out the particle collisions that cause it. The Galileo Project might discover more natural phenomena like the northern lights, he suggested. Or . . . it might discover aliens. No one really knows yet.

When a reporter mentioned Sagan’s famous assertion that extraordinary claims require extraordinary evidence, Laukien replied, “We are not at all—listen to us carefully—we are not jumping to conclusions. We are not making extraordinary claims.” Loeb joined in: “Although I’m a theorist, my approach to this is very observational. It is a fishing expedition. Let’s just go out and catch whatever fish we find.” Both emphasized that their findings will be completely trans-

BYLINES Jennie Rothenberg Gritz is a *Smithsonian* senior editor. Her last feature story was about elephants. Tim O’Brien is an award-winning realist artist and president of the Society of Illustrators.

LOTEM LOEB