
The Guillotine of Evidence:

Extraterrestrials, Astrophysics, and Future of Science

Avi Loeb, Harvard Astrophysicist, in Conversation with Samuel Loncar

Introduction

In the Fall of 2017, atop the dormant volcano Heleakalā, in Maui, Hawaii, Pan-STARRS, a state-of-the-art network of telescopes and cameras, detected a strange object. Discovered by the astronomer Robert Weryk on October 19, 2017, the object, now named ‘Oumuamua (scout, in Hawaiian, also translated “messenger from afar”) is the first interstellar object to be detected in our solar system. Exhibiting a number of strange properties that confounded the initial assumption that it was a comet, it led Harvard astrophysicist Avi Loeb, the Frank B. Baird Jr. Professor of Science, and founder of Harvard’s Black Hole Initiative, to a controversial hypothesis: the best explanation of the object’s physical properties was that it was likely an artificially constructed object from an extraterrestrial civilization. So, he asks, who made ‘Oumuamua, and what is the significance if it is, truly, extraterrestrial in origin?

After writing up his hypothesis with a colleague for a peer-reviewed journal, Loeb published the best-selling *Extraterrestrial: The First Sign of Intelligent Life Beyond Earth* in 2020, which presents a powerful argument for a democratic vision of science, critiques what Loeb sees as the conservatism, elitism, and arrogance among many academics, and presents a detailed argument for why the best explanation of ‘Oumuamua is that it’s alien technology. Loeb confronts the large questions for science and humanity this discovery, as he sees it, must raise, and he does so with imagination and passion. He kindly sat down with me for an hour, and I’m delighted to share the conversation with you, as part of our For the Life of Science series, which brings the joy,

beauty, and power of science into conversation with culture, history, spirituality, and the arts. The video version of this conversation can be found on MRB TV, our new [YouTube Channel](#).

SAMUEL LONCAR

Thank you for your time.

AVI LOEB

Sure. My pleasure.

SAMUEL LONCAR

I was thinking about the scope of your book, which is really about everything. It's about the human species and our place in the cosmos. I was struck by the fact that it's much more than a very sophisticated argument about this incredible interstellar encounter with 'Oumuamua. It's a book about the state of science today. You talk about the currency of conservatism in science, and how certain incentives are damaging science in your view.

So I thought that, instead of starting with the really controversial issue of extraterrestrial life, we might begin by laying out your philosophy and your vision of science. In your book, I saw a pattern emerge of two versions of anthropocentrism that are central to your argument, and I hoped you would discuss them.

You stress humility, on the one hand, and you stress the role of arrogance in some of the problems in contemporary science, on the other; and you show how they animate two different visions of what humans are in science. You argue for what we could call a cosmic humility framework, which motivates your own methodological anthropocentrism in the book.

Your argument is, basically, if humans have done something, then we have no reason to think another species couldn't have evolved or exist that's doing the same thing or more. At the same time, there's a problem theoretically, which is, how do you explain why so many scientists haven't taken the possibility of extraterrestrial life seriously as a scientific pursuit? Why is it that even a scientist of your extraordinary stature gets such pushback?

And I thought, let's flip the frame on the pushback. Let's not make it that ET is weird. Let's make it weird that extraterrestrials are a weird subject. Let's assume, you say, that if we're doing something, others have already done it or could be

doing it, because that's the most humble thing to think. We're not likely to be the only thing around, so why would we think that given the data we have about the cosmos?

On the other hand, how do you explain what I would call, if you'll permit me, a kind of Cosmic Narcissism you see in science, where the default assumption is that our current science is the only game in town, and it's the best that presumably could be in the universe.

AVI LOEB

Yeah, definitely. My explanation for that view is rather simple. When I watched my daughters when they were young, they tended to think that they were the center of the world. And of course, that view changed when I brought them to kindergarten. But they resisted that notion.

You are born into this world, and you are exposed to the data around you. It's all about you. That's the data you get; later in life you recognize that there is a bigger environment. But your first conclusion is that it must be all about you. And in fact, even when people came up with concepts of God, or some divine entity that controls the entire universe, they still thought that God looked over their shoulder. They're really important in the eyes of God, but God would have the entire universe to take care of! Self-centeredness is a natural tendency; my daughters had it. But they changed their view once they went to kindergarten, and I very much hope that our civilization will change its view once we meet others.

Now, how can you change this view? By being open minded. What people usually say is "Extraordinary claims require extraordinary evidence." That was said by Carl Sagan. I see it as an intellectual retreat. Because what it is, really, is a circular argument. Basically, I don't see extraordinary evidence for this proposition; therefore, I don't want to engage in it. But guess what? People talked about supersymmetric particles. And that's an extraordinary claim, right? So, you want extraordinary evidence. What happened?

The scientists decided to allocate \$10 billion to the Large Hadron Collider that would look for evidence for supersymmetric particles. And everyone said, it's just around the corner. And people received honors and awards. It was part of the mainstream of physics, and \$10 billion was spent on building the Large Hadron Collider. It looked for those particles, and it didn't find them in their natural parameter space. Of course, the theoretical physicists retreated and said, "Okay, well, maybe it's just around the corner for the *next* accelerator." I say, *extraordinary evidence requires extraordinary funding*. If you don't fund the search, you will not find anything. And unfortunately, the world of ideas is infinite.

Plato already recognized that. When people are confronted with infinite virtual realities, possible interpretations of the reality we live in, what do they choose? They choose those virtual realities that flatter their ego. So, it flatters our ego to think that we are the center of the universe.

That's why for a thousand years, people believed Aristotle, claiming that we are at the center of the universe. And when Copernicus and Galileo argued otherwise based on what they saw through telescopes, Galileo was put in house arrest. Today, Galileo would have been canceled on social media. That's obvious.

If you ask yourself, "What's the problem here? If a lot of people like an idea, why not accept it?" Well, if you were to ask the philosophers who put Galileo under house arrest, who had much more political power than he did, to design a rocket to reach Mars, they would have gotten it all wrong. Why? Because they would think that Mars moves around the Earth. There is a very simple test. You just ask people to do something in the reality that we all share, and they will get it wrong because they don't understand correctly the reality that we live in. It's not a matter of how many likes you get on Twitter.

There was, about a year ago, an article submitted to and then published in the prestigious journal, *Nature Astronomy*, written by a philosopher who argued that my point—the point that I bring out in the book *Extraterrestrial*—must be wrong, based on philosophical reasoning. And I say: it's not a philosophical point. It's not a philosophical argument.

This is just a matter of collecting enough evidence to figure it out: taking a high-resolution image of an object that looked weird would reveal to us the nature of the object. I don't need this philosopher to come up with philosophical reasoning about why the object must be natural, because we will see it from the image.

So, let's just figure this out based on evidence, the way Galileo said: Look through my telescope. And they refused to do that. It's a natural tendency, you know, that's part of human nature. That's why the metaverse is now a commercial entity, and people go to the metaverse.

I actually had my first interview in the metaverse a couple of days ago. I was interviewed by the avatar of the real person, who looked like a monkey with heart-shaped glasses. I had the interview in the metaverse, but I argued in that interview against subscribing to virtual realities. And you know, philosophers have this tendency to believe virtual realities; also, people, you know, that belong to cults. People that want to believe in the beauty of the world, so they, for example, advocate for the landscape of string theory for the multiverse. Why? Because it's beautiful mathematically. They can spend their life talking about the multiverse and do mathematical gymnastics, and they give each other awards and are liked on

Twitter as part of the mainstream of theoretical physics. That's completely irrelevant.

The question is, can you provide experimental evidence that supports this idea? And if not, forget about it. Either it's not physics, if you can't find that evidence, or it might be ruled out by being tested. People prefer not to subject their ideas to the guillotine of evidence because they know that the party will stop at that point.

SAMUEL LONCAR

I know this is part of your view of science, that is, you want to avoid what you call theory bubbles, getting caught up in complex math without empirical tests. You stress having important insights that claims that interact with data and that people can actually check.

A lot of people, particularly outside of physics, look, rightly, at physics as the peak of science, the peak of the union of the mathematization of nature and what we can reliably know. What happened if, in your analysis, the dominant mainstream of physics, in your view, has ended up, in a way that they would find insulting, like philosophy?

So how would you explain the sciences having taken this turn? Because part of what the book argues is that you have a very different view of science. It is not an elitist view of science. It's a science that's actually accountable to the public. I want to hear more about that, but I think people on the outside, particularly on the outside of science, might be thinking, "Wow, how is it that the physics community itself could have been so misled?"

AVI LOEB

I think a lot of people in academia view it as a status symbol. As a result, they want to distance themselves from the public. And by the way, the public gets that message—the public distances itself from academia. You see that in politics. And so it's a mutual divorce, so to speak. And that's very unfortunate. Because I do think that science should serve society, in the sense of allowing it to get a better understanding of the reality we live in.

When we understand quantum mechanics, we can build gadgets that serve us, like cell phones and the internet. These things change our lives, like the mRNA vaccine for COVID-19. All these things were developed as a result of a better understanding of reality. If you go back 1000 years, some people argued that the human body has a soul, and therefore anatomy should be forbidden. The mRNA vaccine would never have been developed if everyone believed those philosophers that argue that,

you know, you shouldn't hurt the soul of a human by dissecting the body of a human. My point is, science serves society.

And we should be modest because, many times, we've been wrong. As a result, our starting point should be from a very modest perspective; we are not at the center of anything. We are born into this world, like actors put on a stage. And we are not at the center of the stage. We know that now. The play started 13.8 billion years ago in the Big Bang, and we came at the end. So clearly the play is not about us. What we should do is find other actors who have been around longer and may know what the play is about. That's the meaning of life, for me.

I should mention why I have a problem with sticking with ideas and not checking them. It is like the concept of Ponzi schemes. If you've heard of Bernie Madoff, he had a beautiful idea. The idea was so beautiful that not only he believed it, but other people were willing to give him their money, just because it was a beautiful idea. The idea was, give me your money, and I'll make more of it, irrespective of what the stock market does. That's a beautiful idea. Everyone wants to believe it, just like we want to believe that we are the center of the universe. Everyone wants to believe that.

You can live in the multiverse believing that we are at the center of the universe, or that you can make money irrespective what the stock market does. And as long as you live in the multiverse, that may be real for you, but it's a virtual reality. Why? Because when people asked for their money back from Bernie Madoff, he couldn't deliver. That's what I'm talking about. That's when he was put in jail. The laws of physics, or reality, the actual reality we all share, is constraining. It's not whatever you want it to be. You may have fun taking recreational drugs, and having delusions about reality. Okay, you can have fun, but it's not the reality we all share. It's not the reality that is being constrained. You can put cosmetic makeup on your face, and you will look better. But when you take it off, you will see what the reality is like.

I am a physicist. As a scientist, I'm in love with the actual reality. When you are in love with a subject, you want to know everything about that subject. You don't want to have any false impressions of the subject; you actually want to see the pimples on the face of the subject of your love. Why? Because it causes you pleasure to recognize the uniqueness of that person that you love. And I apply exactly the same approach to the reality we all share. As a scientist, I want to learn about it. I want to get evidence, information. It's like going on a date. If you truly enjoy the company of someone, you want to know everything about that someone instead of just believing some notions that appeal to you, just imagining that someone to be that person that you love. But then if you get married to that someone, and you just imagined all those things, reality will prove different. My

point is, it's very tempting for us in the world of ideas to believe in those concepts that flatter our ego.

Unfortunately, that is what even my colleagues in academia do. They subscribe to notions that cannot be tested. And the strange thing is, these notions become mainstream. Mainstream physicists give each other awards and honors. And what I find the most distressing is—well, here is a story.

I was the founding chair of the Black Hole Initiative, which combines philosophers with scientists who study black holes. In the first conference that we organized, there was a philosopher that went to the stage and basically said, "If physicists agree on something for a decade, then it must be right." I raised my hand immediately, and I said, "What do you mean by that?"

It was clear that he was speaking about string theory. And I told him, it doesn't really matter how many likes physicists give each other, or whether they believe in something. If there is a big enough community of people saying the same thing, that's just an echo chamber. What you need is an independent validation of those statements by experiments. And by the way, experiments are done by instruments. You cannot use people as detectors for the reality of an idea.

SAMUEL LONCAR

So, this gets right to the heart of part of your concern about the critique of releasing data before the scientific community has certainty. You say this is just wrong.

I think what you've said so far may already be raising the question that they're trying to address. What happens when the public comes to know that an extraordinarily distinguished astrophysicist at Harvard is saying that the mainstream physics community is actually much more of an echo chamber than they realize? People might think: Well, I thought science was the one place where this is a different pattern, where we have certainty. But you are saying, "No. We need to show the scientific process." So, what would you say to the concern of your colleagues, and even to people reading who might be losing faith in science as certainty?

AVI LOEB

It's really simple. Science is a continuation of my childhood curiosity, in the sense that there is a question.

One of the most vivid memories I have from childhood is that I would ask a question at dinner, and the adults in the room would pretend that they knew the answer, or

would dismiss the question because they didn't know the answer. And that really frustrated me. Why would they dismiss the question?

It's a very important question. I thought that by becoming a scientist, I had the opportunity to maintain that childhood curiosity. I don't want to pretend that I know. I don't care about the labels that I have. You can treat me just as a farm boy. I grew up on a farm. I'm just curious. I'm asking questions.

People pretend to believe they know the answer when they don't know the answer. They just look at each other and invent an answer. They are like those adults in the room when I was a kid, and that really frustrates me because science is supposed to be without prejudice. You're supposed to seek evidence. Now, of course, in a situation like we are discussing, the evidence is expensive. You can't get it for free.

70 years ago, Enrico Fermi was discussing extraterrestrials at Los Alamos during lunch. Everyone agreed that they're likely to exist because back then they said, "Oh, there's so many stars."

Now we know that half of the stars, like the Sun, have a planet the size of the Earth, roughly the same separation. Our backyard is not really unique, and he didn't know that. And moreover, we know that most of the stars are from billions of years before the sun, so there was plenty of time for other civilizations to get their act together and send the equipment that will reach us, okay.

Anyway, Enrico Fermi didn't know that. So, he asked, "Where is everybody?" Now, to me, this is very pretentious because it's just like someone sitting at home on the sofa and saying, "I don't hear a knock on my door; therefore, I don't have neighbors."

Now, my point is, you have to look through your window, and you better do it with telescopes. It reminds me of this fisherman that went to sea. And he came back and said, "I've discovered the new law of nature: all fish are bigger than two inches!" So someone asked him, "What's the size of the holes in your fishing net?" And he said, "Two inches."

Now, Enrico Fermi didn't even have a fishing net! He was sitting next to the ocean and saying, "Where are all the fish? I don't see anything." You need to invest funds in building telescopes that will survey the sky and search. You can't just ask these questions. It's childish. Do you think that because you're in Los Alamos, they will come and visit you in Los Alamos at the time that you're asking this question, so that you will know for sure that they exist? Why would they do that?

Recorded human history is 10,000 years old. The Earth existed for a million times longer. If they came to visit, why would they do it exactly when Enrico Fermi is

asking this question? My point is, we have to invest funds in the search because we did that over and over for 40 years. We've been searching for the nature of most of the matter in the universe, dark matter. And that's legitimate, that's considered part of the mainstream of astrophysics. I started astrophysics forty years ago, when people were saying, "Oh, the dark matter will be found within a few years, it's most likely Weakly Interacting Massive Particles." We invested hundreds of millions of dollars searching for those particles, but we haven't found them.

We put very tight limits on the initial parameters people imagined. And so I asked one of the experimentalists once, "How long will you continue to search for those Weakly Interacting Massive Particles (WIMPs)?" And he said, "As long as I'm funded."

Let's imagine a situation where we invest hundreds of millions of dollars in the search for equipment from other civilizations in space. And if for 40 years, we don't find anything, then in 40 years, we will be exactly at the same point where the people that search for WIMPs, as dark matter, are right now. And nobody says anything about it. It's part of the mainstream. So, I see that as a very strange situation.

Beyond the fact that we invest in directions that did not produce anything, and that is common practice in mainstream, imagining something like us is not really speculative. We know that we exist. But beyond that, you find people in the mainstream that are pursuing string theory, concepts about extra dimensions. Some of their advocates are proud of the fact that they're leading the frontier of physics. What are they leading? They didn't make a single prediction about the Big Bang. What happened before the Big Bang? They didn't make a single prediction about what lies inside the black hole.

These are the fundamental questions we have, in trying to unify quantum mechanics and gravity.

They don't have a unique theory, but they keep bragging about the fancy mathematics that they develop. (With arrogance, they are leading the frontier of physics, giving each other awards. And that's really the culture in academia.) In my mind, it's more speculative than talking about something like us. Why would people push back on the notion of searching for extraterrestrial equipment? That is something that we did! So why would it be speculative? Why should this be banned? Why should there be a stigma on this subject? It's completely beyond me.

SAMUEL LONCAR

You mentioned in the beginning of the book, as you were discussing your education and your love of philosophy, that you realized the line between philosophy, science, and theology is razor thin.

And that connects to the point you're making. The way we use the term "science" now in English only goes back, at the earliest, to the nineteenth century. Before that it was called natural philosophy and part of philosophy in a much broader sense.

It seems, in that very expansive sense of philosophy, part of what you're offering is a critique of the unreflective philosophy that is current in science.

Science and philosophy, not in the academic sense of philosophy, but philosophy as something rooted in wonder, is rooted in our own ignorance. That's what Plato and Aristotle said. Science and philosophy come out of the fact that we don't know something, that it makes us curious. But then, as you point out, adults are often the class of society that shut down child-like curiosity and wonder.

That's part of what I found so powerful about the book. You're willing to be so passionate, and you're willing to hold up children as an example of science, to return us to the roots of science. Do you think, in that sense, philosophy and science are closer together and that having a more expanded vision of the way in which science should be self-reflective has been an asset to you? That science, on your view, needs to recognize it should be thinking about itself, talking about itself, arguing about itself in public, and that, far from undermining its credibility, that might be a way of bringing the public in, engaging them?

AVI LOEB

Definitely. As a young kid, I was interested in philosophy. And that gave me a different perspective than many of my colleagues in science. They are drilling in a very narrow niche, and therefore, they're not really seeing the big picture.

But what I want to emphasize is that I attended the forum in the Washington National Cathedral about a couple of months ago. In that forum, Jeff Bezos was speaking about space tourism. And I thought to myself, "Going outside the solar system, it cannot have a business plan, you cannot make a profit out of it." Going far away into another planetary system around another star has to be driven by a sense of spiritual reality, the sense that there is something beyond the confines of our immediate environment. And we want to explore it. I see a connection between space exploration and spirituality.

And I was talking with a reverend in that forum about this. My view is that a very advanced scientific civilization is a good approximation to God, in the sense that we already are getting close to producing synthetic life in our laboratories. Once

we understand how to unify quantum mechanics and gravity, we might even be able to create a baby universe in our laboratories. I can imagine that in millions or billions of years, a civilization as advanced as we might be would be an approximation to what religious scripts or theologians called God.

So, there is a way to unify science and religion. This concept of some entity able to create life, to create a universe out of nothing, may be just technological advancement. If that's the case, then science and religion are connected.

And, you know, having the Big Bang come out of a laboratory is like imagining many generations of people having babies and the babies have babies, and so forth. If you create a universe like our own, inside of which there is an advanced technological civilization, that creates a baby universe, you can have babies, from babies from babies. That would explain the Big Bang. And then, in my mind, it's worth exploring our cosmic neighborhood, because there might be a technological civilization that is a billion years old, or older than us, and we could learn from them.

Now, it may feel like copying in an exam where you have a student that is much, more, much more talented than you are next to you. And you're copying the answers from the student, but I don't care. If we can get a leap, a Quantum Leap by a million years or a billion years in our knowledge, then we better get it.

Why wait? We will not survive that long. And, you know, looking for a package in our mailbox, which I call the solar system, is actually quite important. Because I don't want to be in a situation like finding a love letter in the attic that was intended for someone that died before reading it. I want to find the love letter when I'm still alive.

If another civilization gave us the recipe for our salvation, for how to save our planet, what to do in the future, I want to find that letter.

SAMUEL LONCAR

That's very powerful. In the context of the history of religion, and particularly before religion and philosophy split as much as they have, it was totally normal, for example, that indigenous cultures believe ontologically that there were other beings that were conscious that weren't them. This is still true today.

But the modern Western world, what we associate with the kind of world created by the scientific revolution—that's a very complicated story—ends up producing a mindset that says: there's nothing but us.

So, on your argument that there's a kind of approximation between a very advanced technological civilization and the concept of God, wouldn't that also then suggest that the resistance to something like extraterrestrials could be a kind of lag or hangover from a form of cultural atheism that no longer has a *raison d'être*, but is still contemptuous of the idea that there could be something other than us?

AVI LOEB

Yeah, definitely. I think if there is a committee in the Milky Way Galaxy, trying to decide whether there is an intelligent civilization near the sun... Well, when they look at us, they might decide that it's not intelligent yet, based on the way we behave.

Look at human history or look at science. We are not open minded. My hope is that in the future, we'll open our eyes to the world around us and be willing to learn more. And then, of course, the way to do that is by exploring space by collecting data. I established the Galileo Project in July 2021, for that purpose, to follow the guidance of Galileo. The Galileo Project is about learning about our cosmic environment by collecting data.

SAMUEL LONCAR

Right. The actual name of the object from Hawaii is 'Oumuamua: "Scout," or "The Messenger from Afar." This is, in many ways, what your book is about and what our conversation is about, and what the Galileo Project is about. What is the message?

You have a message about what science is. And that message implicates all of us. But you're also pointing out the alternative, what's currently happening in science, as you characterize it, which also has a message: *Don't bother looking*.

What is the message for someone reading who hasn't read the book? What do you want them to know that so essential about the data of 'Oumuamua?

I know you explained it very carefully in the book, but I just wanted to give you a chance to speak to people who haven't read the book. Obviously, there are different theories, but they all require an extraordinarily new type of object, that we haven't seen before.

AVI LOEB

Right. Right. Well, first, I wanted to make a comment, one possible solution to Fermi's Paradox, which we mentioned earlier, is that the extraterrestrials are putting

goggles of the metaverse on their eyes and are not taking part in the reality that we all share.

Or that they are philosophizing about it and not engaging with anyone else. That's a possible explanation to Fermi's Paradox. I would prefer to believe otherwise.

Now, an object was discovered in October 19, 2017. And it was the first object from outside the solar system that was spotted near Earth by a telescope in Hawaii called PanSTARRS. It was given the name of 'Oumuamua because it means a scout, a messenger from far away, in the Hawaiian language. At first astronomers thought, well, it must be a comet because comets are icy rocks. When they get close to the sun, they warm up and the ice evaporates. And you see a cometary tail of vapor and dust that reflects sunlight. It's very natural to assume that the first object from another star would be a comet because these comets originate from the outskirts of the solar system.

When you imagine another star passing by, it can easily dislodge some of these icy rocks into interstellar space. And the same can happen around other stars. So, the first assumption is to say an interstellar object is a comet. The only problem is, the data didn't show any evidence for a cometary tail.

There was not even any trace of carbon-based molecules around the object using the Spitzer Space Telescope. So, it was not a comet, despite what astronomers thought initially. And then as it was tumbling, every eight hours, the amount of sunlight reflected from the subject the size of a football field, changed by a factor of 10. And that meant that it had a very extreme shape, most likely pancake-like, a flat base on the variation of light, at a 90% confidence. Then it was pushed away from the sun by some mysterious force that declined inversely with distance squared from the sun. And it wasn't clear what can provide that push because there was no rocket effect from evaporation.

The only explanation I could think of was, the reflection of sunlight is pushing it. But for that the object had to be very thin like a sail. Nature doesn't make such objects. I suggested, maybe it's artificial. And in September 2020, there was another object that shared the qualities of 'Oumuamua discovered by PanSTARRS, the same telescope, and it was pushed away from the Sun by reflecting sunlight and had no cometary tail. Then it was realized a few weeks later that it came from Earth. It was a rocket booster, from a 1966 launch of a mission to the moon. And we know that it had thin walls, and that's why it was pushed away from the Sun by reflecting sunlight, and it had a large area for its weight. We know that we produced it artificially. The only question is: who produced 'Oumuamua?

One additional point, to answer to your question. The point is that other people in the mainstream resisted the idea that it's artificial, and they try to explain it as a

natural object. Explanations, all of them, invoke something that we've never seen before, like, for example, a hydrogen iceberg, where the hydrogen evaporates, you can't see it, and it still provides the rocket effect, like a comet. The only problem is such an object would get evaporated very quickly and wouldn't survive the journey. Then there was a suggestion that it's a nitrogen iceberg. The only problem there is the mass budget, that is, there is not enough nitrogen on the surface of planets that would allow a solid nitrogen [iceberg] to make enough of those chips. And then there was a suggestion that maybe it's a cloud of dust particles, very loosely bound, 100 times less dense than air, and then it will be pushed like a feather by reflecting sunlight. And the problem there is it wouldn't survive the heating by the sun that would raise its temperature by hundreds of degrees. So, in all of those cases, it was suggested that 'Oumuamua was something we've never seen before.

My point is, if it's something we've never seen before, we better contemplate the possibility that it's artificial because it's just like a caveman finding a cell phone. The cavemen would argue that it's a rock of a type that he had never seen before. And that would be the natural explanation, given the fact that this caveman played with rocks all of his life. But of course, the way to figure out the nature of this cell phone is for the cavemen to press a button that records his voice to press another button to record his image. And then it will become clear that it's not a rock.

SAMUEL LONCAR

So, this is really the most extraordinary event that we've ever recorded astronomically; it's the first time we have had something come through the solar system that is clearly Interstellar. No one disagrees on that. Since you've published your work on this and established the Galileo Project has there been any change? Or do you foresee any change on the part of your colleagues? Or do you at least hear things informally, perhaps from younger physicists and astrophysicists? I'm curious, what the developments have been around your work. Do you see any signs of hope that things are changing?

AVI LOEB

Well, I must tell you, it has been a remarkable journey. I had about 2000 interviews over the past year. And then, about six months ago, a number of very interesting people came to visit the porch of my home—I met them in the porch simply because of COVID.

But there were some quite exceptional individuals, and a few multi-billionaires that were inspired by my book and came to ask questions. And then, at some point, it was obvious to me that there is a huge amount of interest from the public. The public has its heart in the right place.

Those entrepreneurs said, here is some money for your research. And within a few weeks, I had \$2 million without doing any fundraising. And I said, okay. A month earlier, I submitted a white paper to NASA because the head of NASA, Bill Nelson, said that these unidentified aerial phenomena (UAPs) reported by the Director of National Intelligence to Congress should be studied by scientists, that this is a serious matter. So, I sent my white paper and didn't hear back.

And so I said, I don't need the federal funds. I can just do it from donations. And I established the Galileo Project and an amazing thing happened—more than 100 scientists join me.

Some of them told me, “We were waiting for this kind of an initiative for many years, but it was stigmatized by the mainstream of science. And we are so happy that you announced it.” And then I got thousands of emails from very excited individuals. And a lot of young people, who are worried about their job prospects, if they were to work on a subject like this, because the adults in the room would ridicule the subject. So, they might not get the job. That's the most harmful consequence. We can't even argue and discuss it.

The problem is, if the adults in the room dismiss a question and ridicule it, and are not allocating funds towards studying that question, it is a self-fulfilling prophecy. As a result, young people decide not to engage in it, and the status quo is maintained. And this is not very different from the Dark Ages.

If you think about it, there were some dogma back then, and when Galileo tried to argue otherwise they put him in house arrest, and basically everyone was afraid. That's authority trying to establish what reality is. Now, the point is, reality doesn't care what the authority says.

So, if we don't look through our window, and we argue that we are unique and special, and we ridicule anyone discussing any other notion, it will not get rid of our neighbors. That's a very simple point. And it's amazing that the public as a whole is quite excited about it. My book came out, and it was translated to 25 languages, and there were about 30 filmmakers and producers that approached me. It was quite spectacular. But at the same time, of course, I had all this pain inflicted on me by colleagues, saying things that are quite hurtful.

The only analogy I could make is when I was young—I was born in Israel, so I had to serve in the military. And my early training was in the paratroopers. I remember this notion that sometimes the soldier needs to put his body on the barbed wire, so that other soldiers will be able to move forward. That's the way I feel, that I have to put my body on the barbed wire so that the young generation of today will be able to explore this subject in the future.

But I should say there was a complete change in the intellectual culture as a result of all of this. Let me give you just a few examples. One, the US government, the Congress, legislated recently the establishment of a new office in government that will collect data on Unidentified Aerial Phenomena. And actually, this legislation was triggered by an amendment put forward by Senator Kirsten Gillibrand. And she mentioned explicitly the Galileo Project. I was stunned because I never spoke with any politician, any senator, about the project, yet it was included in the language of her amendment. That was remarkable.

And then, guess what? President Biden signed it into law. So, by June 2022, that will be in government studied in a serious way with a budget (it was part of the defense bill.) Unidentified Aerial Phenomena are objects that are within the Earth's atmosphere, so the fact that the political system takes it seriously, I think, is a change. It's not being stigmatized anymore. This was part of the Defense budget, which was \$778 billion for 2022.

Now, imagine that the Galileo Project will find evidence for extraterrestrial equipment. Now, imagine that the political system at that point would say, "Well, this is a subject of importance, as important as national security." Then we will have a trillion dollars a year to study this subject.

This is thousands of times more than the biggest science projects ever. The Large Hadron Collider got \$10 billion. The James Webb Space Telescope got \$10 billion over several decades, from multiple nations. I'm talking about thousands of times more funding for the search. And that's if we find conclusive, undisputable evidence that there is a piece of extraterrestrial equipment floating in space. Then just think about it, the implications for humanity are extraordinary.

I think the biggest implication that I can foresee is that it will make us modest, humble. The Perseverance Rover on the surface of Mars is looking for microbes, for primitive life on Mars. But imagine that it would bump into the wreckage of a spaceship that represents technologies we don't possess—that would be a blow to our ego.

But then, more importantly, if you look at human history, you see over and over again, groups of people trying to feel superior relative to other people and causing a lot a lot of damage. And the best example is the Second World War, where the Nazi regime triggered the death of 75 million people. That was 3% of the world population back in 1940. And it's 10 times more than the number of deaths triggered by COVID-19, so far. We've been talking about COVID-19 for two years now. And just a group of people deciding to feel superior, within a few years, kill 10 times more people. Just because they want to feel superior relative to others.

Now, my point is, if we find a smarter kid on our cosmic block, that would bring a sense of modesty. We will realize that the differences between us are really meaningless, and that we should all treat each other with respect as equal members of the human species.

SAMUEL LONCAR

And this is part of “‘Oumuamua’s wager,” which you discuss in the book. Basically, you argue we have nothing to lose by studying ‘Oumuamua and searching for extraterrestrial technology. The worst-case scenario, just like you mentioned, is that we could be 40 years into what we’re already 40 years into: theories that haven’t cashed out on your view, but in which we have invested billions of dollars.

But *what we have to gain* makes this search the greatest venture capital project ever, because, for a modest investment, the whole history of humanity is changed forever. And you’re suggesting it’s already different, the paradigm shift is happening. You’re bringing that to the public. And you’re also arguing this is what we, in the scientific community more broadly, need to be thinking about.

AVI LOEB

Yeah, there is also the issue of the protocol of response. Because if you think about it, in the past, we thought about receiving a radio signal. That is just like having a phone conversation; you need the counterpart to be active at the time that you’re having the conversation. But the thing is that even the nearest star is four light years away. So, a round trip conversation takes a decade, and the implications are not immediate.

We don’t have to worry about rushing into a decision or anything. But if you think about equipment hovering near Earth, it’s just like having a person in your backyard, and you need a prompt response. We don’t have a protocol for that. And we need to get organized. We need some kind of an organization that represents humanity. We need to do the right thing. We don’t want to act like the citizens of Troy, the way they dealt with a Trojan horse, right? Being too naive.

So, we might need to use AI systems to interpret their AI systems. Artificial Intelligence systems, much smarter than we are, I think, are the most likely encounter, because biological creatures are not designed to survive long trips between stars. Then I think we should be brave. And obviously, if we see something, we should monitor what kind of information it’s seeking, what it does in response to what we are doing, and whether or not to engage with it, and how. But all of this is new territory. That’s my point.

I think there is a lot of room for philosophers, for people from the humanities to contribute because they have a broader picture. Scientists are used to dealing with things they are used to dealing with, like physical objects. The universe is large, but it can still give us an opportunity to feel superior because the universe is controlled by physical laws that we can uncover in laboratory experiments. So, we scientists feel superior because the universe is deterministic, or even in the context of quantum mechanics, probabilistic, but in a way that we can formulate it.

Every atom behaves in a way that we can forecast. There is no freewill to those atoms that we see from the edge of the universe. So, we feel that we are superior, very intelligent, and that we can choose our actions in some way. We have self-consciousness.

So, I would argue that physics allows us to remain arrogant. And studying microbes on Mars allows us to remain arrogant. That's why these concepts are part of the mainstream. But studying something smarter than us is not part of the mainstream because it disturbs us.

If I came to my daughters when they were young, before they went to kindergarten, and said, "You know, I heard about a kid out there. I see a kid. They're walking on the street now and that kid looks smarter than you are." Well, they would say, "nonsense" and not look through the window.

SAMUEL LONCAR

It's a powerful vision. And I wish we had more time to talk about the protocol of response, because I love what you mentioned: that it would be a place for people outside of science in the narrower sense, like people in the humanities.

I think that's one of the deep questions: Who should be doing this? And how do we do it, given that the people in charge the mainstream, by your reading, have already missed some opportunities?

AVI LOEB

I'm trying to change that. And as some very wealthy people are listening to me, so just watch. Stay tuned, and things will change.

SAMUEL LONCAR

Thank you very much, Professor Loeb. I'm so grateful for your time and thanks for your book. I look forward to your work in this symposium.

AVI LOEB

My pleasure, thank you.

Abraham (Avi) Loeb is the Frank B. Baird, Jr., Professor of Science at Harvard University and a bestselling author (in lists of the New York Times, Wall Street Journal, Publishers Weekly, Die Zeit, Der Spiegel, L'Express and more). He received a PhD in Physics from the Hebrew University of Jerusalem in Israel at age 24 (1980-1986), led the first international project supported by the [Strategic Defense Initiative](#) (1983-1988), and was subsequently a long-term member of the [Institute for Advanced Study](#) at Princeton (1988-1993). Loeb has written 8 books, including most recently, [Extraterrestrial \(Houghton Mifflin Harcourt, 2021\)](#), and about 800 papers (with an h-index of 117) on a wide range of topics, including black holes, the first stars, the search for extraterrestrial life and the future of the Universe. Loeb is the Director of the Institute for Theory and Computation (2007-present) within the Harvard-Smithsonian Center for Astrophysics, and also serves as the Head of the [Galileo Project](#) (2021-present). He had been the longest-serving Chair of Harvard's Department of Astronomy (2011-2020) and the Founding Director of Harvard's Black Hole Initiative (2016-2021).

[Samuel Loncar](#) is a philosopher and writer, the Editor of The Marginalia of Books, and the creator of the Becoming Human Project. His work focuses on integrating separated spaces, including philosophy, science and religion, and the academic-public divide. He's currently writing a book on how to heal the divide between philosophy, science, and the search for human meaning. Learn more about Samuel's writing, speaking, and teaching at www.samuelloncar.com. Tweets @samuelloncar