

# Defenses That Hurt Science

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By Avi Loeb on June 4, 2021

In the highlighted subtitle of a recent New-York Times [Op-Ed](#), Bret Stephens stated: "Sometimes science is hurt most by those who think they are defending it". This sentiment resonates with many examples that go beyond the topic of his Op-Ed. Let me elaborate.

When the [nitrogen iceberg model](#) was proposed recently to explain the [weird properties](#) of the first interstellar object [`Oumuamua](#), it was immediately embraced by mainstream astronomers with a sigh of relief that the anomalous object was finally explained. We had never seen a chunk of frozen nitrogen floating within the Solar system before, and being detected first - [`Oumuamua](#) should represent the most common type of objects ejected by other planetary systems; but this was of little concern for the advocates. Shortly afterwards, my student Amir Siraj and I posted a [paper](#) showing that this model requires much more raw material of heavy elements than available in stars within the Milky Way galaxy. This was not a reflection on the previously noted [abundance problem](#) for interstellar objects, but a specific deficiency of the nitrogen model - which associates [`Oumuamua](#) with a fragment chipped off the surface of a Pluto-like planet around another star. The limited supply of nitrogen on exo-Pluto surfaces and the requirement that the interstellar journey would last just half a billion years - or else most of the nitrogen would evaporate, leads to a mass budget problem. But why should the mainstream worry about a fundamental drawback when the agenda is to sideline the [weirdness](#) of [`Oumuamua](#)?

In another recent [Op-Ed](#), Seth Shostak from the SETI Institute downgraded the scientific credentials of the anticipated [report](#) on Unidentified Flying Objects ([UFOs](#)), to be delivered by the Pentagon and various intelligence agencies to Congress this month. He suggested that "... the document to be dropped on lawmakers' desks will not be very different from the conclusions of UFO studies by the military more than a half-century ago." However, science is not to be dictated by authoritative statements based on past experience. Instead, progress relies on appreciating anomalies and actively pursuing new clues when the existing data is insufficient. Catchy phrases like Shostak's: "everyone could see Santa's sleigh cruising the skies if they'd only wear Nicole Richie sunglasses" could earn many "likes" on Twitter from a like-minded crowd, but they do not bring us closer to the truth. Uncertainty should encourage scientists to seek more data rather than get entrenched in our pre-conceptions. In this spirit, former top-level government officials who had access to the classified UFO data, including former U.S. President [Barack Obama](#), former Intelligence Director [John Ratcliffe](#), former CIA Director [James Woolsey](#) and former Senator [Harry Reid](#), stated recently that they believe UFOs are real objects but they do not understand their nature. UFOs are intriguing enough that the forthcoming report should motivate scientists to [collect more data](#) and unravel their nature based on quantitative analysis, just as is customarily done in the context of other scientific mysteries, such as the unknown nature of dark matter in the Universe. The pretentious posture that we are smart

enough to know the answer in advance, results in a self-fulfilling-prophecy loop that dismisses the need to collect new data, which in turn supports the premise that the existing data for the anomalies is not convincing. This loop maintains a status-quo of ignorance about the scientific facts and preserves the public's confusion. The goal of science is to gain new knowledge and clear up the fog, possibly moving us out of a mistaken comfort zone.

Anomalies should be celebrated rather than ridiculed. They offer an opportunity to learn something new about nature. Discoveries naturally rattle pre-conceived notions. [Quantum entanglement](#) or "action at a distance" appeared "[spooky](#)" to Albert Einstein, but physicists accepted it when they learned from later experiments that he was wrong.

Altogether, science is work in progress. Most of the time there is not sufficient data to narrow down the range of possible interpretations. Under these circumstances, we are often advised by colleagues not to reveal to the public how the "sausage" of scientific knowledge is made, because the public might lose trust in the scientific consensus on other issues like global [climate change](#). My view is exactly the opposite. By exposing the common state of science in which multiple interpretations are entertained when evidence is inconclusive, we would gain the public's trust in our assertions once we gather evidence beyond a reasonable doubt. If scientists only engage the public to announce "final" results in press conferences, we create a class system where academia is viewed as being elevated on a pedestal, similar to the status of a lecturer among students. The alternative approach of transparency in deliberation throughout the process of discovery alleviates the perception of science as an occupation of the elite.

Recently, it became fashionable among philosophers to defend theoretical physics fashions such as the [string theory landscape](#), the [multiverse](#), [supersymmetry](#), [extra-dimensions](#), or some versions of [cosmic inflation](#), which are immune to experimental falsifiability tests in the foreseeable future. These popular areas of mathematical gymnastics do not "[put skin in the game](#)" and avoid making predictions that can be falsified by experimental data. This led some to suggest that the tent of physics needs to be redefined more broadly to include philosophy. Recently, Jeroen van Dongen joked in the concluding sentence of a review [paper](#): "... I would like to propose a name for the new non-empirical paradigm, honoring its Kantian credentials: let's call it '*meta*'- physics, and keep funding it as generously as before." My preferred interpretation of this suggestion is that the funding level of untestable theories in physics should match the current support of [metaphysics](#).

Redefining science is not the right way to maintain its vitality. There are still numerous thriving frontiers in modern science where experimental feedback is practiced and appreciated as a necessary element of the scientific method. Science does not need defense from those who violate its sacred principle of advancing evidence-based knowledge.

## ABOUT THE AUTHOR



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Avi Loeb is the founding director of Harvard University's Black Hole Initiative, director of the Institute for Theory and Computation at the Harvard-Smithsonian Center for Astrophysics, and the former chair of the astronomy department at Harvard University (2011-2020). He chairs the advisory board for the Breakthrough Starshot project, and is a former member of the President's Council of Advisors on Science and Technology and a former chair of the Board on Physics and Astronomy of the National Academies. He is the bestselling author of "[\*Extraterrestrial: The First Sign of Intelligent Life Beyond Earth\*](#)".