Prompt: Hyperrealistic hyperpop cheesy painting of an extraterrestrial humanoid alien wearing old-timey hunting gear sitting on a horse.

Alien Hunting

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After reading the depressing geopolitical news this morning, I wondered whether we could benefit from advice provided by a superhuman intelligence in our cosmic neighborhood. Suppose we chose to be proactive and seek the best imaginable advisor by advertising the job of God and hoping for candidates, what would this job description entail? Surely, we would require any viable candidate to know how to create a Universe.

Our scientists do not know what happened before the Big Bang because Albert Einstein's theory of gravity breaks down at that singular moment. However, if we have had a theory that unifies quantum mechanics and gravity, we could have figured out the conditions that gave birth to our Universe. Having that recipe would have enabled us the know-how for potentially creating these conditions in the laboratory.

Terrestrial backdrop

There are hundreds of billions of stars in the Milky Way galaxy alone, and most of them formed billions of years before the Sun. This gives ample time to quantum-gravity engineers of an advanced extraterrestrial civilization to create baby universes in their laboratories and be qualified to apply to our job description of God. It would greatly benefit us to find them, even if imitating their technological insights would feel like cheating in an intelligence test.

Could we find our interstellar partners with our modern telescopes? Extraordinary evidence requires extraordinary funding. If we had invested ten billion dollars in the search, similar to the budget allocated to the Large Hadron Collider or the Webb Telescope, we might have found our cosmic partners by now and the cosmos might not have been as lonely and dark as it appears to us now. Over the past seventy years, we searched for radio signals from other intelligent civilizations. But this is like waiting for a phone call. Nobody may be calling us while we are waiting. A better approach is to search for packages that may have arrived at our mailbox. The senders may be dead, but any trash they left behind in the ocean of interstellar space, could be our treasure.

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Prompt: Hyperrealistic hyperpop pastel colors alien family next door consisting of alien father, mother and child standing on the porch of their suburban home waving

Finding interstellar artifacts

Interstellar is the space that lies beyond the solar system. Traditionally, we used telescopes to observe remotely what lies near other stars. But remote observing is limited to extremely bright objects. If we ever discover an interstellar car, similar to the dummy payload launched in 2018 by SpaceX, we will know that Elon Musk is not the most accomplished space entrepreneur since the Big Bang.

Over the past decade, astronomers discovered the first few interstellar objects. As described in my book "Extraterrestrial," the football-size object 'Oumuamua was discovered by the Pan-STARRS telescope in Hawaii on October 19, 2017. The brightness of sunlight reflected off 'Oumuamua changed by a factor of ten as it tumbled every eight hours. These extreme brightness variations implied that 'Oumuamua was shaped like a pancake. This mysterious object accelerated away from the Sun without signs of cometary evaporation, and receded from Earth faster than any human-made rocket. A similar push by reflection of sunlight was detected for another object, 2020 SO, which was verified to be a rocket booster from a 1966 launch by NASA.

Variation in brightness of 'Oumuamua as observed by various telescopes during three days in October 2017. Different colored dots represent measurements through different filters in the visible and near-infrared bands of the color spectrum. The amount of reflected sunlight changed periodically by about a factor of ten (2.5 magnitudes) as 'Oumuamua rotated every 8 hours. This implied that it has an extreme shape which is at least ten times longer than it is wide when projected on the sky. The dashed white line shows the curve expected if 'Oumuamua were an ellipsoid with a 1:10 aspect ratio. However, the best fit to the light curve from its tumbling motion implies a flattened, pancake-shaped configuration rather than an oblong, cigar-shaped object as commonly depicted in the media. (Credit: ESO/K. Meech et al.)

Prompt: The brightness of sunlight reflected off football-size object 'Oumuamua in hyperrealistic hyperpop pastel color style

"Its tumbling motion implies a flattened, pancake-shaped configuration rather than an oblong, cigar-shaped object."

An interstellar meteor: technological artifact or a rock?

As described in my latest book "Interstellar", the first interstellar object to be detected was an interstellar meteor named IM1, half a meter in size, that collided with Earth on January 8, 2014. Outside the Solar system, IM1 was moving at 60 kilometers per second, faster than 95% of all stars near the Sun. Despite its high speed, it disintegrated in the lower atmosphere, where the air is dense. This implied that it was tougher than all meteors documented by NASA over the past decade in its CNEOS catalog of meteor fireballs.

"The BeLaU composition is unfamiliar and different from the composition of the crust of the Earth, Mars, the Moon, asteroids and comets and potentially flags an origin from outside the solar system. Its origin is unknown."

It took my research team a full year to plan an expedition to the fireball site of IM1 in the Pacific Ocean. The location was determined by satellites of the U.S. Department of Defense, which detected the light from IM1's brilliant fireball. Collecting molten meteoritic droplets (spherules) from the ocean floor was particularly challenging because the ocean is a mile deep at that location and the search region is 7 miles in size. Our team anchored a sled full of magnets to a ship called "Silver Star" and dragged it on the ocean floor across the survey region. We visited IM1's impact site on June 14–28, 2023 and collected 850 tiny droplets, less than a millimeter each.

For some of the retrieved spherules retrieved from IM1's fireball site in the Pacific Ocean, the abundances of various elements from the periodic table, such as Beryllium, Lanthanum or Uranium, are up to a thousand times higher than in material that made the Solar system. The full analysis can be found in the related peer-reviewed paper which details the findings (Loeb et al., Chemical Geology, 670, 122415, 2024).

It took us a year to analyze the recovered droplets. By now, we published our findings in a detailed peer-reviewed paper.

Our analysis used state-of-the-art laboratory instruments (including a micro-X-Ray Fluorescence analyzer, Electron Probe Microanalyzer and an Inductive-Coupled-Plasma Mass-spectrometer). We found that about a tenth of the total population of droplets had a chemical composition that was never reported before in the scientific literature. It is characterized by an enhanced abundance of some chemical elements, such as beryllium (Be), lanthanum (La) and uranium (U), up to a thousand times more than the materials that made the Solar system. We labeled this special set: "BeLaU"-type spherules. The BeLaU composition is unfamiliar and different from the composition of the crust of the Earth, Mars, the Moon, asteroids and comets and potentially flags an origin from outside the solar system. Its origin is unknown.

But curiosity-driven science never ends. Our analysis raises new questions: What is the age and material properties of IM1? Is IM1 natural or artificial in origin? Where did it come from and how long was its journey?

Science is better than politics

We are currently planning our next expedition for summer 2025, with the goal of answering these questions. Aside from identifying the nature of IM1, finding large pieces from its wreckage would allow us to determine the age of IM1 from its radioactive isotopes, to find the composition of volatile elements that were lost from the spherules we retrieved, and also to gauge IM1's material strength and thermal properties, potentially explaining why it maintained its integrity despite witnessing atmospheric stress beyond the tolerance of the toughest iron meteorites known in the Solar system.

To find larger pieces of IM1, we intend to use a robot named Hercules, accompanied by a video feed that would allow us to see what we are picking up. Our imagination is limited by our past experience, but nature can surprise us. Finding clues for a partner from another star can be more inspiring than following our politicians.

"Our imagination is limited by our past experience, but nature can surprise us."

Prompt: Hyperrealistic hyperpop pastel colors weird alien landscape