Considering the existence of a parallel universe

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Parallel universes. Credit: Eugene Oks, Author provided

Why did the valet hate being in a parallel universe?

Because it was all parallel parking!

A parallel universe is one of the favorite subjects of fiction writers. There are numerous books, films, video games and TV series based on

the hypothesis of parallel universes. This hypothesis is actually much older than any fiction book: It was entertained by the ancient philosopher Plato and can be also found in Hindu mythology.

The hypothesis of the existence of a parallel universe or universes (in the latter case, called multiverse) has proponents and opponents among astrophysicists. Additionally, there is a certain degree of fascination with the so-called wormholes—hypothetical tunnels (through a higher dimension) that presumably might connect parallel universes. While wormholes are theoretical products of the Einstein gravity (the general theory of relativity), their existence has never been confirmed.

Coming back to the hypothesis of parallel universes, the primary argument against this hypothesis was the lack of the observational evidence. In response, the proponents suggested (at different times) that the following two kinds of observations might constitute such evidence.

One theory was that the observed cold spot (that is, a lower temperature spot) in the distribution of the cosmic microwave background (CMB) radiation, nestled in the constellation Eridanus, is the remnant of a collision between our universe and another "bubble" universe during an early inflationary phase. Let me clarify that the CMB is the electromagnetic radiation initially produced in the visible range of the electromagnetic spectrum shortly after the Big Bang. As it traveled through the expanding space, its wavelength increased—this phenomenon is called the cosmological red shift. Now, it is observed in the microwave range of the electromagnetic spectrum.

There was also a version of the same theory suggesting that the cold spot could be the imprint of another universe, caused by quantum entanglement between universes before they were separated by cosmic inflation. However, a more thorough analysis of data from the Wilkinson Microwave Anisotropy Probe (WMAP) and from the Plank satellite,

which has a resolution three times higher than WMAP, did not reveal any statistically significant evidence of such a bubble universe collision.

Another theory was based on an early observations of "bulk flow," which is a stream of galaxy clusters moving in the same direction, where the bulk flow velocity was found to be more than 4,000 km/s. These observations were first interpreted as evidence of the existence of a parallel universe whose gravitational pull causes this bulk flow. However, later, more precise observations (from the Plank satellite) revealed that the average cluster velocity is at the level of just 120 to 160 km/s. The authors of these more precise observations wrote that this "constitutes an unprecedented and valuable confirmation of a prediction of the standard cosmological scenario," so that this proposed evidence of the existence of a parallel universe should be discarded.

The idea I would like to present (published in my research paper of 2022 in the peer-reviewed journal *Foundations*) provides a reconciliation of the observed so-called anisotropy of our universe (that is, the dependence of the CMB temperature on the direction of observation) and the measured, relatively low velocity of the stream of galaxy clusters (the gravitational pull from the "outside").

In fact, lots of totally different kinds of astrophysical observations demonstrated that in our universe there exists a preferred direction (called the "axis of evil" by one astrophysicist). Namely, many observations at the wide range of frequencies suggest a preferred direction pointing roughly toward the Virgo supercluster. This direction is close to the three aligned axes of the three types of observed anisotropy of the CMB (the three types being dipole, quadrupole and octopole). Moreover, radio and optical polarizations from distant sources also indicate a preferred direction pointing roughly toward Virgo.

All these different types of astrophysical observations are statistically

independent of each other. Therefore, the existence of the preferred direction (or axis) in our universe is indisputable. This hints at a gravitational pull from the "outside." Yet, the gravitational pull was measured to be relatively small: no more than 160 km/s.

Here is a possible way to reconcile the indisputable existence of the preferred direction in our universe with the relative smallness of the gravitational pull from the outside. Let us consider two three-dimensional universes (one of which is ours) embedded in a four-dimensional space. (Here and below, I mean only spatial dimensions.) The two universes rotate about their center of mass (called barycenter) in such a way that the centrifugal force nearly (though not exactly) compensates their mutual gravitational pull. In this configuration, within each of the three-dimensional universes, there would be a preferred direction: the direction to the other universe. Also, in this configuration, the bulk flow velocity (in each of the universes) would be relatively small because the centrifugal force nearly compensates the gravitational force.

This scenario seems to explain all corresponding astrophysical observations. So it seems to be self-sufficient. Nevertheless, I'd like to mention that there could also be non-astrophysical evidence for this scenario, as presented below.

In one of my research papers, published in 2021 in the peer-reviewed journal *International Review of Atomic and Molecular Physics*, and in my corresponding popular article published in September 2021 on Science X Dialog, I focused at the following three perplexing features of unidentified flying objects (UFOs) from the latest official report by the U.S. Office of the Director of National Intelligence, in which, out of 144 relatively recent observations of UFOs by the U.S. military, recorded by various detection systems, 143 remained unexplained. First, some UFOs demonstrated accelerations (measured by detection systems) of about

700 g. Humans, even the astronauts, cannot stand such acceleration. Second, UFOs can appear suddenly, almost instantaneously, and disappear suddenly, almost instantaneously, which is impossible for man-made aircraft. Third, these observed UFOs were able to travel in air and water, back and forth, without any significant change of the dynamics, also impossible for man-made aircraft.

For a more visual presentation of my main idea, in that paper of 2021, first I discussed the following. If an experimentalist would shine a laser beam on a distant surface (for example, on the surface of the moon) and rotate the laser with some angular velocity, the bright spot can travel across the distant surface with a very large linear velocity—even exceeding the speed of light. (No physical law would be violated because it is information that cannot be transmitted faster than the speed of light, while the bright spot cannot transmit any information from one place on the surface to another.)

If the experimentalist engaged the laser in various movements, and if there were two-dimensional intelligent creatures living on the surface the laser illuminates, they would observe huge "accelerations" of the bright spot, the sudden appearance and disappearance of the bright spot, and the ability of the bright spot to travel through dry ("air") and wet ("water") sections of the surface without changing the "dynamics." (More details are in my research paper of 2021 and in my popular paper of September 2021 at the Science X Dialog, at the link provided above.) All of this would be beyond technological capabilities of the two-dimensional creatures. So they would call the bright spot (or spots) a UFO (or UFOs) and would rack their brains trying to explain them.

At this point, in my paper of 2021, I wrote the following:

"Now, let us add an extra spatial dimension both to the 'surface' and to the space from which the light is shined. Now the 'surface' becomes our

three-dimensional world, into which the light is incoming from the fourth spatial dimension. In our world, we see a three-dimensional 'bright spot." This "'bright spot' is the projection of the light coming from the four-dimensional world on the three-dimensional 'screen," the 'screen' being our three-dimensional world."

Obviously, in this situation, we would observe and register by detection systems all of the above three perplexing features of the three-dimensional "bright spot"—the features that are far beyond our technological capabilities—and we would call such three-dimensional "bright spots" UFOs. In other words, within this explanation of all three perplexing features of the observed UFOs, the UFOs are the three-dimensional projections of the light entering our world from the fourth dimension. Further, in my paper of 2021, I wrote:

"By varying the intensity distribution of the cross-section of the light beam at the source (for example, by using filters), it would be possible to create any shape and form of the three-dimensional projection that we observe, including the shape of "flying saucers," and so on. By varying color filters or their combinations, it would be possible to make the three-dimensional projection of any color or their combinations."

I had explained that the detailed information on properties of the electromagnetic radiation in four spatial dimensions was provided in the research paper by Corben in 1946. According to that paper, the only one difference of the electromagnetic wave in four spatial dimensions from the electromagnetic wave in three spatial dimension is that in the four-dimensional case, it is intertwined with a weak oscillatory gravitational field (the gravitational field oscillates in the direction of the propagation of the electromagnetic wave). As for the electric and magnetic components of the 4-dimensional electromagnetic wave, they are the same as in the three-dimensional world.

Next, in my paper of 2021, I wrote:

"The source of light could be located and controlled in a parallel three-dimensional world by three-dimensional relatively advanced civilization that developed the capability to manipulate the electromagnetic radiation in the way described above. By projecting the light into our three-dimensional world and detecting the reflected light, they monitor our technological capabilities."

The only one alternative hypothesis—the UFOs being extraterrestrial drones—has several flaws. The primary flaw is that the extraterrestrial drones scenario cannot explain the sudden, almost instantaneous appearance of the UFOs and the subsequent sudden, almost instantaneous disappearance of the UFOs. Also, in the drone scenario, the extra-terrestrial civilization should be extremely advanced—otherwise, it would not be able to make spacecrafts that can withstand the acceleration of 700 g and can interchange the motion in the air and under water without any significant change of the velocity. In distinction, in the scenario of the UFOs being the three-dimensional projections, it would be sufficient for the other civilization to be only slightly advanced—just to be capable of manipulating the electromagnetic radiation in the way described above. Last but not least: The only one practical purpose of the UFOs is to monitor our technological capabilities. However, since so far, our astrophysicists did not detect any extraterrestrial civilization located within hundreds of light years from the Earth, the advanced civilization controlling the extra-terrestrial drones would receive the information only in many hundreds years or even in many thousands years. In distinction, in the scenario where the UFOs are the three-dimensional projections, the information carried by the reflected light, could reach the origin of the light in just few years or less—because the parallel three-dimensional world could be just few light years (or less) away from our three-dimensional world across the four-dimensional space.

So it seems that the configuration of two parallel three-dimensional universes embedded in four-dimensional space (where they rotate about their barycenter) explains not only all relevant astrophysical observations, but also the perplexing features of the observed UFOs (that have no consistent alternative explanation).

By the way, in comments to my popular article of September 2021 at the Science X Dialog, one of contributors noted that when UFOs enter the water from the air, a splash is observed. The contributor asked whether my scenario, in which UFOs are just the three-dimensional projections of four-dimensional electromagnetic radiation, can explain the splash. Here is my answer.

According to the detailed study by Corben (quoted above), the four-dimensional electromagnetic radiation consists of the electromagnetic wave in three spatial dimensions, the wave being intertwined with a weak oscillatory gravitational field. The combination of the gravitational field "impact" on the water and of the water boiling by the electromagnetic component could create the appearance of the splash.

Finally, it is important to emphasize that just the totality of the astrophysical observations—those proving the existence of the preferred direction in our universe, as well as astrophysical observations where a weak but non-zero bulk flow (the gravitational pull from the "outside") has been measured—seems by itself to be sufficient for making viable the proposed configuration of the two rotating, parallel three-dimensional universes. I hope that my work might stimulate further discussion of these issues.

Let me finish with the following joke:

Scientists have invented a way to send messages to parallel universes. They are calling them "parallelograms."

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More information: Eugene Oks, Possible Observational Evidence for the Existence of a Parallel Universe, *Foundations* (2021). DOI: 10.3390/foundations2010001. doi.org/10.3390/foundations2010001

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Biography:

Eugene Oks received his Ph.D. degree from the Moscow Institute of Physics and Technology, and later the highest degree of Doctor of Sciences from the Institute of General Physics of the Academy of Sciences of the USSR by the decision of the Scientific Council led by the Nobel Prize winner, academician A.M. Prokhorov. According to the Statute of the Doctor of Sciences degree, this highest degree is awarded only to the most outstanding Ph.D. scientists who founded a new research field of a great interest. Oks worked in Moscow (USSR) as the head of a research unit at the Center for Studying Surfaces and Vacuum, then —at the Ruhr University in Bochum (Germany) as an invited professor, and for the last 30 plus years—at the Physics Department of the Auburn University (USA) in the position of Professor. He conducted research in 5 areas: atomic and molecular physics, astrophysics, plasma physics, laser physics, and nonlinear dynamics. He founded/co-founded

and developed new research fields, such as intra-Stark spectroscopy (new class of nonlinear optical phenomena in plasmas), masing without inversion (advanced schemes for generating/amplifying coherent microwave radiation), and quantum chaos (nonlinear dynamics in the microscopic world). He also developed a large number of advanced spectroscopic methods for diagnosing various laboratory and astrophysical plasmas—the methods that were then used and are used by many experimental groups around the world. He recently revealed that there are two flavors of hydrogen atoms, as proven by the analysis of atomic experiments; there are also possible astrophysical proofs—from observations of the 21 cm radio line from the early Universe and from the observed distribution of dark matter in the Universe. He showed that dark matter or at least a part of it can be represented by the second flavor of hydrogen atoms. He has published about 550 papers and 10 books, including the monographs "Plasma Spectroscopy: The Influence of Microwave and Laser Fields", "Stark Broadening of Hydrogen and Hydrogenlike Spectral Lines in Plasmas: The Physical Insight", "Breaking Paradigms in Atomic and Molecular Physics", "Diagnostics of Laboratory and Astrophysical Plasmas Using Spectral Lineshapes of One-, Two, and Three-Electron Systems", "Analytical Advances in Quantum and Celestial Mechanics: Separating Rapid and Slow Subsystems", "Advances in X-Ray Spectroscopy of Laser Plasmas", "Simple Atomic and Molecular Systems: New Results and Applications", and "Advances in the Physics of Rydberg Atoms and Molecules". He also published a popular book "Unexpected Similarities of the Universe with Atomic and Molecular Systems: What a Beautiful World". He is the Editor-in-Chief and/or the Editorial (or Reviewers) Board member of 8 well-established refereed physics journals. He is also a member of the International Program Committees of the two series of conferences: Spectral Line Shapes, as well as Zvenigorod Conference on Plasma Physics and Controlled Fusion.

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