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Astra News
November'22
~ January'23

When looking at the cover above, please turn THIS *music on, "Magnolia" from " Organ" by* Jun Konagaya.

Image *from Official SpaceX Photos on Flickr.*

Table of Contents

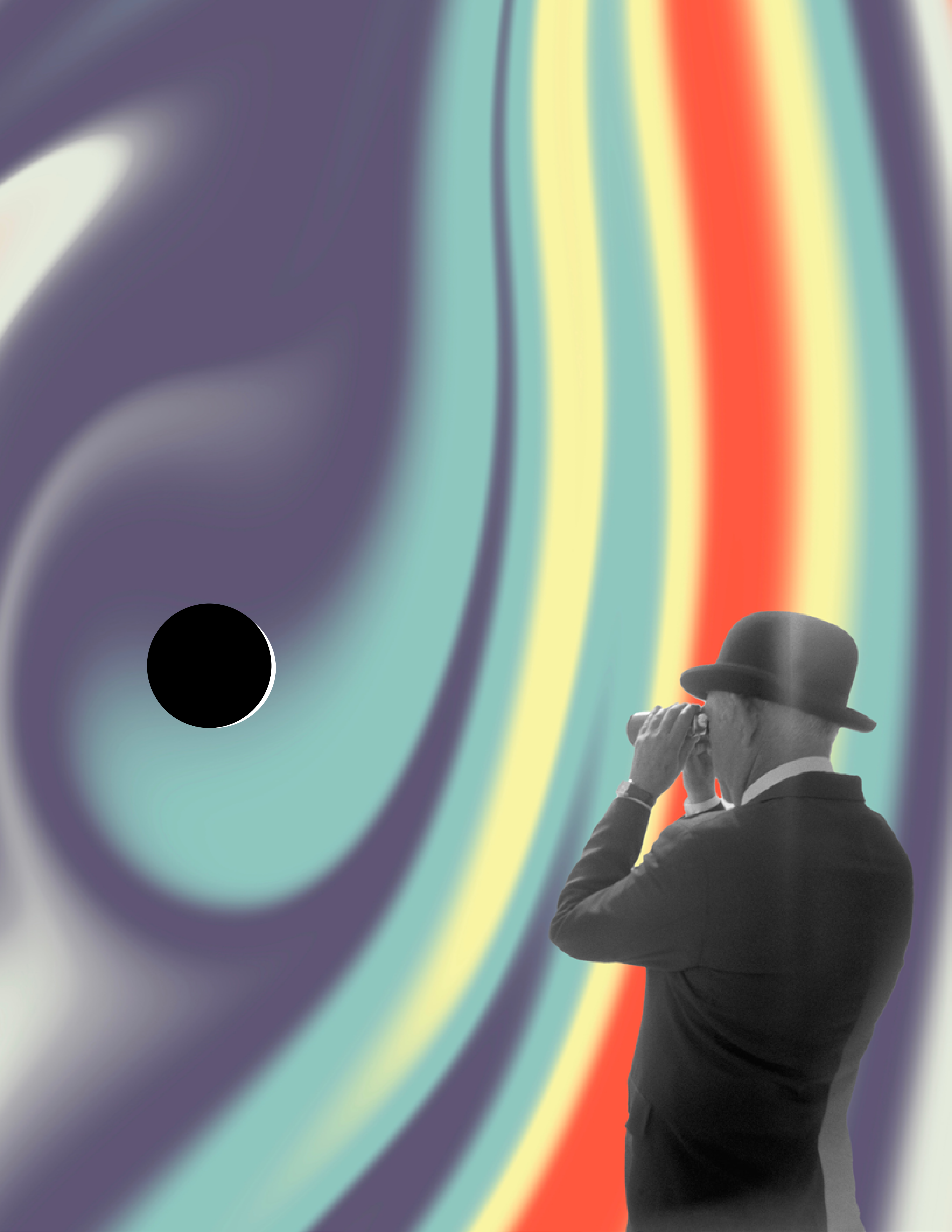
▲▲ *On the cover: a collage by Leonid Vishnevskiy. Images used are a bird from the painting "*The Hunters In the Snow*" by Pieter Bruegel the Elder, an image of a boy from "*Scanno, 1962*" by Mario Giacomelli and an image by* Eugene Golovesov *from Unsplash.*

◀ *On the left is a collage by Leonid Vishnevskiy. Images used are from the public domain.*

NON FICTION

In this issue

Collage by Leonid V. Images used are from the public domain including an image by Visax from Unsplash.



Prions are little-studied protein molecules with a modified shape and interesting properties. Although they do not carry genetic information, like viruses, bacteria, and fungi, they are capable of using their host's cells to reproduce.

Prions reproduce by direct contact with a healthy protein, after which it transforms into a prion.

Prions cause diseases of the nervous system. However, the incubation period of such diseases is long, as a considerable number of prions is needed to create a tangible effect on the host body, so scientists believe that it is possible to develop a drug that blocks the growth of prion accumulation and thus stop the disease.

Prions

and Their Connection to Genetics

By Sophia Nyberg

In 1982, when Stanley Prusiner first introduced the word "prion", it immediately became heresy (Vogel 214). His hypothesis was that prions were "novel proteinaceous infectious particles". (Prusiner 136) The New Oxford American dictionary defines "proteinaceous" as "consisting of or containing protein". According to one article, some examples of prion diseases are Creuzfeldt-Jakob disease, Variant Creuzfeldt-Jakob disease, Kuru, Bovine Spongiform Encephalopathy, and scrapie. (Centers for Disease Control and Prevention) However, in the 1950s, David R. Wilson said that genetics could play a role in these diseases. (Wilson)

To find some connections between prions and genetics, let us look at the US National Scrapie Eradication Plan. For scrapie, USDA identifies three genes in the pathogenic prion protein that play a role in disease: 136, 154, and 171. USDA cites that Codon 154 plays a minor role in scrapie susceptibility. There are five options for what Codon 171 can be: glutamine (Q), lysine (K), histidine (H), and arginine (R). The effect of K on scrapie resistance has not been determined, and USDA states that H is equivalent to Q in terms of scrapie resistance. "A" stands for Alanine, and can be ignored. From this information and Codon 136, you can find 4 codons with different levels of resistance: AARR, AAQR, AVQR, and AA/AV/VV QQ. (United States Department of Agriculture Animal and Plant Health Inspection Service) and also some minor alleles such as AHQ (New Zealand Ministry of Primary Industries Biosecurity New Zealand):

- "AA RR sheep are nearly completely resistant to scrapie." (United States Department of Agriculture Animal and Plant Health Inspection Service) Biosecurity New Zealand cites that all sheep with the AR allele are "genetically resistant to scrapie". "Resistance of ARR/ARR genotype sheep to scrapie is not absolute: two, possibly three, cases of classical scrapie have been reported in sheep of this genotype (Groschup et al 2007, Goldman 2008)" (New Zealand Ministry of Primary Industries Biosecurity New Zealand) and the USDA cites a case of an AARR sheep in Japan being infected with scrapie. USDA's National Scrapie Eradication Plan allows producers to keep RR sheep without restriction unless RR sheep are exposed. In that case, the entire flock is quarantined. Some of the sheep in the flock may be sent for genetic testing. (United States Department of Agriculture Animal and Plant Health Inspection Service)

- Sheep carrying the AHQ allele also have genetic scrapie resistance. (New Zealand Ministry of Primary Industries Biosecurity New Zealand)

- AA QR Sheep are also very resistant to scrapie, but certain cases still occurred in Europe, mostly in flocks with high scrapie occurrence. USDA's National Scrapie Eradication Plan allows producers to keep AA QR sheep without restriction unless AA QR or RR sheep are exposed. In that case, ewes are quarantined while rams are free. QQ sheep and the offspring of exposed animals, however, are always quarantined. Some of the sheep in the flock may be sent for genetic testing. (United States Department of Agriculture Animal and Plant Health Inspection Service)

- AV QR Sheep are less probable to contract scrapie then QQ sheep. At the time of the cited USDA report, there were only two cases of AV QR sheep contracting scrapie in the United States. USDA's National Scrapie Eradication Plan allows producers to keep most AV QR sheep without restriction unless AV QR, AA QR, or RR sheep are exposed. In that case, ewes are quarantined while rams are free. QQ sheep and the offspring of exposed animals, however, are always quarantined. (United States Department of Agriculture Animal and Plant Health Inspection Service)

- The risk level of all RR and QR sheep, even when scrapie is contracted, is lower than that of QQ sheep. Scrapie tends to remain in the brain in such sheep (United States Department of Agriculture Animal and Plant Health Inspection Service) and the brain is a very high-risk tissue for scrapie. (World Health Organization)

- All QQ Sheep are at the highest risk for scrapie "and can transmit the disease to susceptible flock mates". (United States Department of Agriculture Animal and Plant Health Inspection Service)

USDA Policies involving exposed animals with scrapie:

Positive animal(s)	**-----------------------Exposed animals--------------**				
	Goats	**QQ Sheep**	**AVQR Sheep**	**AAQR Sheep**	**RR Sheep**
AAQQ sheep and goats	Doe — X Buck — EX	Ewe — X Ram — EX	Free	Free	Free
AV and VV sheep	Doe — X Buck — EX	Ewe — X Ram — EX	Ewe — X Ram — Free	Free	Free
AAQR sheep	Doe — X Buck — EX	Ewe — X Ram — EX	Ewe — X Ram — Free	Ewe — X Ram — Free	Free
RR sheep	XX	XX	XX	XX	XX

From: United States Department of Agriculture Animal and Plant Health Inspection Service. The Genetics of Scrapie Susceptibility.

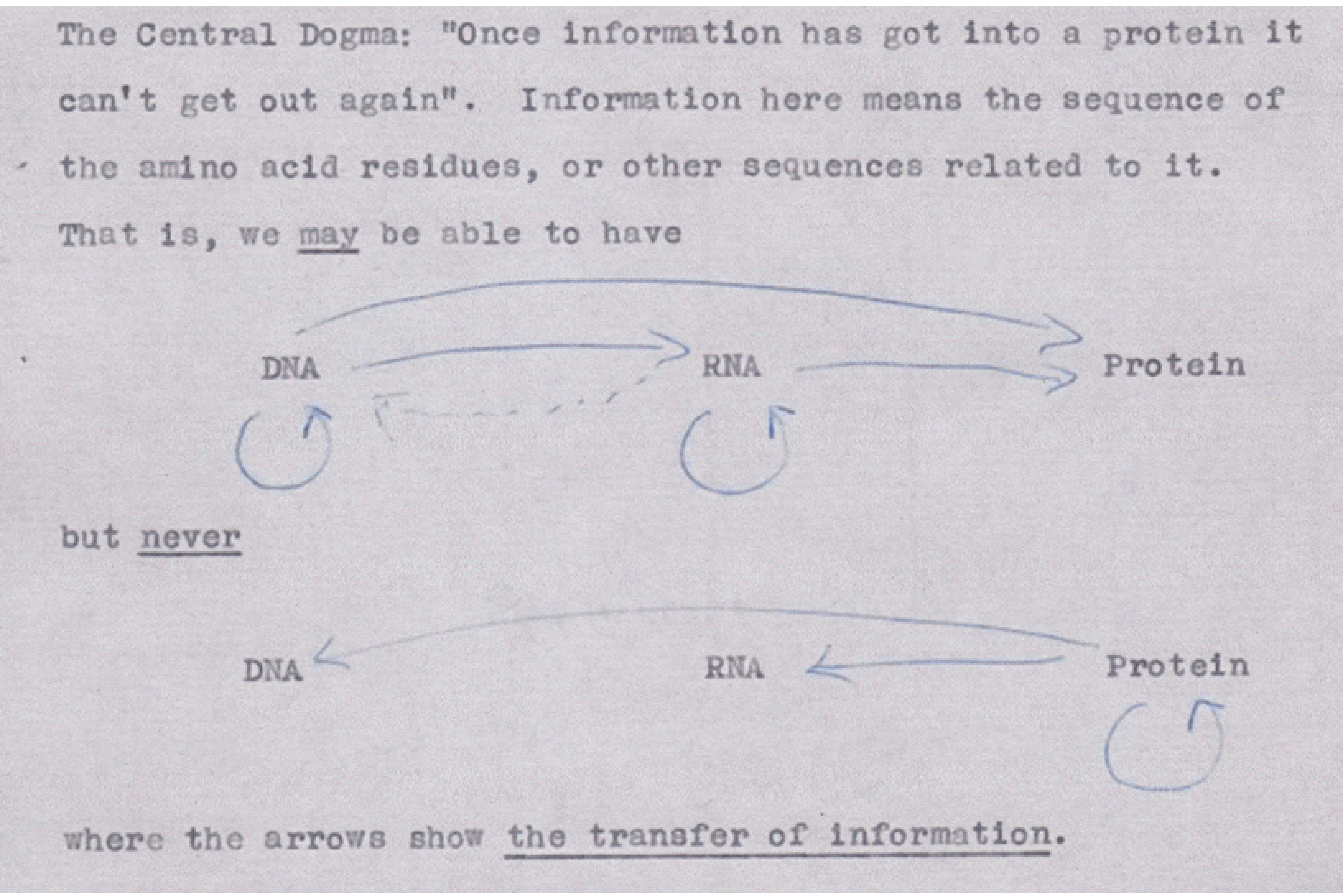
The conclusion from this is that when an animal is exposed to scrapie, the genetic makeup of the animal can mean the difference between life and death.

There is a second connection between prions and genetics: **genetic prion diseases.** There are three major genetic prion diseases: gCJD (or genetic CJD), FFI (fatal familial insomnia), and GSS (Gerstmann-Sträussler-Scheinker) syndrome. (Zerr and Schmitz)

A GeneReview on prion diseases states that "Genetic prion disease is inherited in an autosomal dominant manner." Some cases of genetic prion diseases also come from heterozygous parents. (Zerr and Schmitz)

In conclusion, prions and genetics are connected due to genetic prion diseases.

A third connection between prions and genetics is sequence similarity in the nucleotide sequence of the protein.


The Central Dogma: "Once information has got into a protein it can't get out again". Information here means the sequence of the amino acid residues, or other sequences related to it. That is, we may be able to have

DNA RNA Protein

but never

DNA RNA Protein

where the arrows show the transfer of information.

From: Cobb, Matthew. "60 years ago, Francis Crick changed the logic of biology." PLOS Biology, 2017.

The above figure shows that the main processes listed by Crick (the blue lines) as being possible are DNA to RNA, DNA to Protein, RNA to protein, DNA to DNA, and RNA to RNA. In this section only the first three of these processes will be covered.

If you conduct a nucleic acid BLAST search between human and bovine PrP, there will be a significant sequence alignment.

A version of the search is accessible as a Wayback Machine capture here or as a PDF by following this link.

If you look at the final search, there will be sequence alignment with only one sequence. Here is a partial alignment between both sequences:

```
GGCTGCTGGATGCTGGTTCTCTTTGTGGCCACATGGAGTGACCTGGGCCTCTGCAAGAAG
 ||| | ||||| |||||||||||||||||||||||||||| |||||||||||||||||
GGCAGTTGGATCCTGGTTCTCTTTGTGGCCATGTGGAGTGACGTGGGCCTCTGCAAGAAG

CGCCCGAAGCCT---GGAGGATGGAACACTGGGGGCAGCCGATACCCGGGGCAGGGCAGC
 || || || ||| |||||||||||||||||||| ||||||||||| || ||||||||
CGACCAAAACCTGGAGGAGGATGGAACACTGGGGGGAGCCGATACCCAGGACAGGGCAGT
```

From: here *(HTML), Alignments Tab or* here*, Page 4 .*

Almost at every place in the sequences there is a line between them. This shows striking similarities between the two sequences (National Center for Biotechnology Information), which is proven by scientific research papers. According to one paper: “Three genes (PRNP, PRND, and RASSF2) exhibited significant sequence similarities, but human PRNT did not have a corresponding sequence in cattle.” The above image, which is only a partial alignment, only focuses on the PRNP gene (Choi et al.) and so does the BLAST alignment as well. (National Center for Biotechnology Information)

The conclusion from this is that sequence alignment connects prions with genetics.

The conclusion from all of these similarities is that although prions are proteins (Prusiner 136)**, they still bear similarities to nucleic acids and genetics in certain ways.**

This is very important because of the recent discoveries, especially CRISPR-Cas9, a gene editing tool. This way, there is more hope for making a cure for prions.

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National Center for Biotechnology Information. “Results for RID-J2MA26UG114; Job Title NM_000311:Homo sapiens prion protein (PRNP),...” BLAST: Basic Local Alignment Search Tool, 14 September 2022

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A Brief History of the Beginning of the Space Race

By Bohdan Plotnytskyi

When you hear about a country's airspace being violated, it means that an aircraft flew over its territory without rising at least 100 kilometers above sea level, or the so-called Karman line. The Karman line is a conditional boundary between the atmosphere and space.

The first artificial object in history to cross the Karman line was the V-2 ballistic missile, which was able to fly up to 188 kilometers. This was in 1944, shortly before the end of the Second World War, at Peenemünde Airfield in Germany. Peenemünde Airfield was part of the Peenemünde Army Research Center, best known for the development of guided missiles and rockets, the most well-known example being the V-2.

The V-2 (German: Vergeltungswaffe 2, Retaliation Weapon 2) was the world's first long-range guided ballistic missile. This rocket was made under the direction of Wernher von Braun. At that time, he was 25 years old. It was not his first rocket, and it was the most successful. It was part of his Aggregat series of projects (hence its other name, A-4). The Aggregat series (German for "Aggregate") was a set of ballistic missile designs developed in 1933–1945 by a research program of Nazi Germany's Armed Forces.

Wernher von Braun is a legendary figure in space exploration history. Like Sergei Korolev, he dreamed of flying to the Moon, but things did not go as anticipated. When Hitler came to power in Germany, von Braun was involved in the development of ballistic weapons. Sergei Korolev would also be assigned to develop weapons.

Wernher von Braun (in suit) with Nazi officers in 1941. Image source.

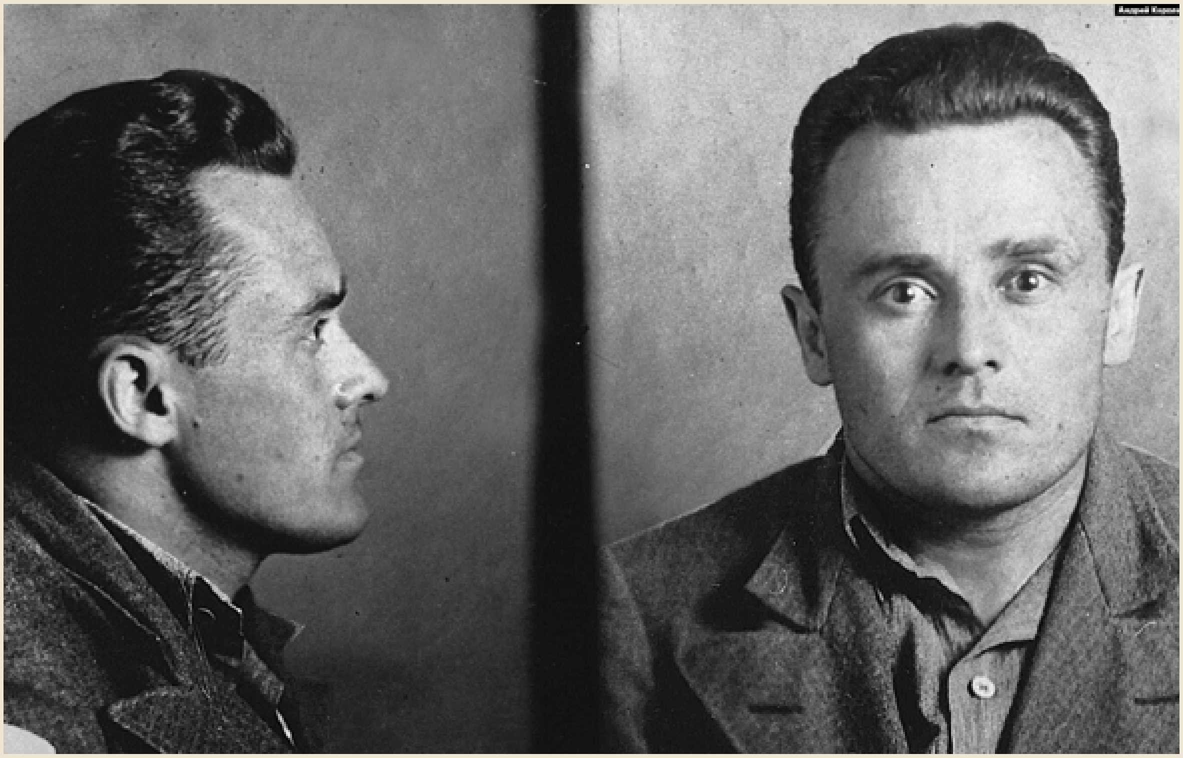
A V-2 rocket on display in the Science Museum (London, UK). Image source.

In 1944, as the defeat of the Third Reich in the war was becoming increasingly clear, the Nazis created the Vergeltungswaffe program. The “weapon of retaliation” was what a number of Nazi Germany's aviation and rocket artillery projects were called. Their goal was to create weapons for more effective bombing of English cities and newly planned attacks on the United States, as "retaliation" for Allied raids. It was at this time that von Braun's A-4 rocket was adopted and given the V-2 index.

However, the adoption of this rocket into service did not affect the outcome of the war, and when Germany lost, von Braun, along with all of the other top scientists, including his colleagues, hurried to leave the Peenemünde Army Research Center and went to surrender to the Allies, trying to avoid being captured or surrendered to the main enemy of Nazi Germany, the Soviet Union.

May 1945. Von Braun posing to a camera while surrendering to U.S. troops after breaking his arm during an escape attempt from Peenemünde. With him are Major General Walther R. Dornberger (left), commandant of the Peenemünde, Lt. Col. Herbert Axter, senior scientist (no hat), and scientist Hans Lindenberg (right). Image source.

The fact is that the Soviet Union not only suffered greatly compared to other countries from the Nazi regime that seized power in Germany, but at that time Joseph Stalin was also in power in the Soviet Union, whose repressions inside the country were well known in the West. In other words, von Braun rightly feared spending the rest of his life in the Stalinist camps, through which even the innocent and patriotic (despite being tortured in the Stalinist camps) Chief Designer Sergei Korolev had spent five years of his life in (June 1938 - July 1944), which irreparably altered his health.



Future Chief Designer Sergei Korolev, June 1938, in Butyrskaya prison. Image source.

This is how all the top scientists and engineers in rocketry led by von Braun, who worked for Nazi Germany, ended up in the US, and ultimately determined its success in space exploration. The US hired them under the covert Paperclip Operation*. Meanwhile, the USSR got German airfields and technical specialists.

In the future, the main figure with whom the development of astronautics in the United States was associated with was von Braun, and in the USSR - Sergei Korolev (until his death he was known only as the “Chief Designer” and not by name, since that information was classified).

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* *"In a covert affair originally dubbed Operation Overcast but later renamed Operation Paperclip, roughly 1,600 of these German scientists (along with their families) were brought to the United States to work on America’s behalf during the Cold War. The program was run by the newly-formed Joint Intelligence Objectives Agency (JIOA), whose goal was to harness German intellectual resources to help develop America’s arsenal of rockets and other biological and chemical weapons, and to ensure such coveted information did not fall into the hands of the Soviet Union."* Source

In 1947, the Cold War began in which two blocs "fought" for world domination: the NATO bloc led by the United States and the Warsaw Pact bloc led by the USSR.

The Soviet Union and America built up nuclear power to deter each other. But the USSR had a problem; in order to drop a bomb, you need to carry it on an airplane, but then there were no planes with a sufficient flight range to fly to the United States since the USSR did not have bases near the US. America, meanwhile, had many bases across the world from which they could fly planes to the Soviet Union. Therefore, the USSR had to develop a rocket that could cope with the long trip.

Sergei Pavlovich Korolev was assigned to do this. Due to the fact that the USSR did not get complete blueprints of the V-2, Korolev and his colleagues had to think it through themselves.

In 1948, the R-1 ballistic missile was developed with a flight range of 270 km—which was not enough. A year later, the R-2 missile with a flight range of 600 km was made—that was still not enough.

America had complete blueprints of the V-2 and its inventor, but there was no urgent need to invent something. Therefore, they tested a rocket with a range of 600 km only in 1953.

In turn, in 1953, the Soviet Union already loaded the R-5 in the Astrakhan region with a range of 1200 km—though even this was still not enough. After 4 years, the R-7 rocket with a flight range of 8000 km was ready.

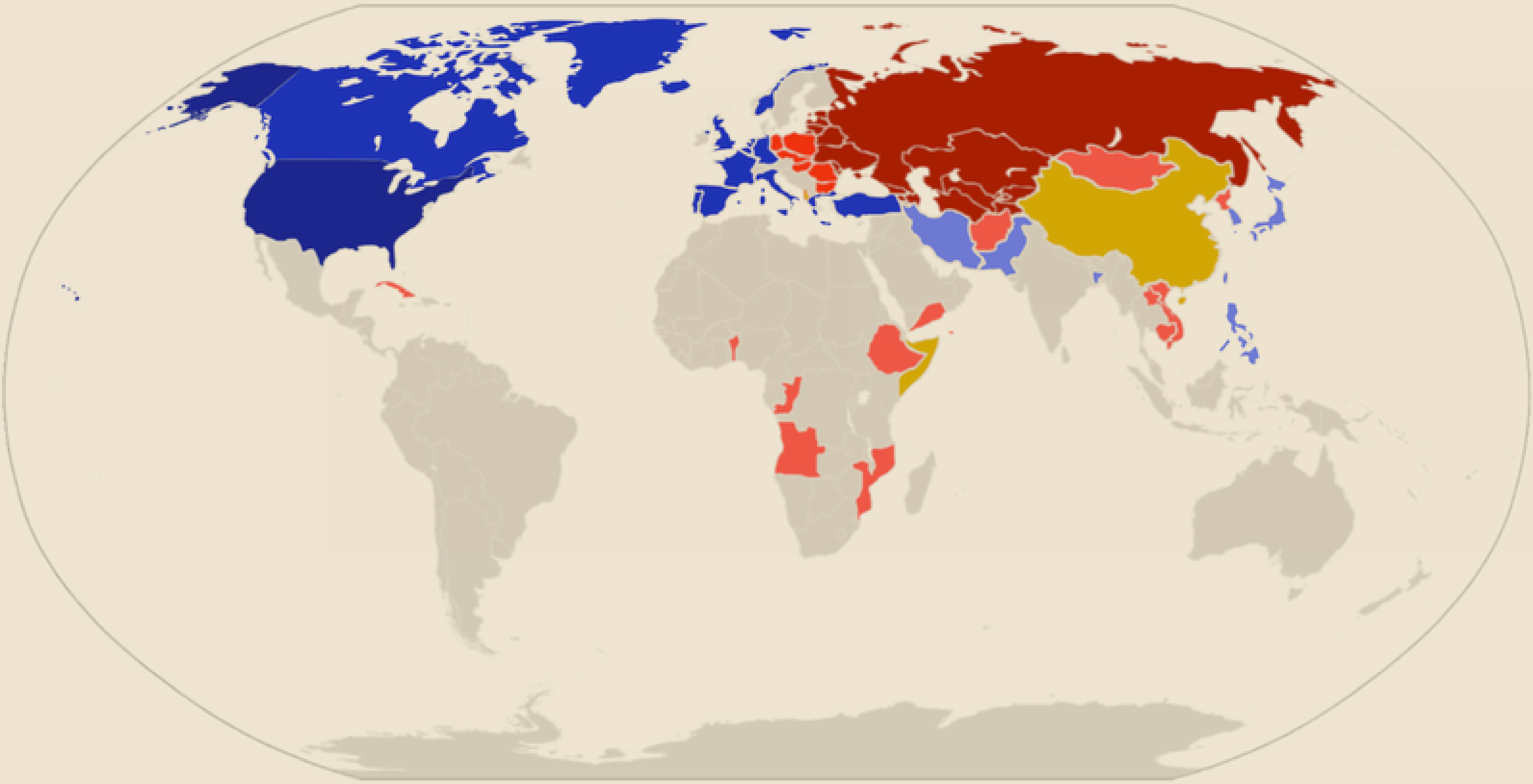
On August 21, 1957, it took off from the Baikanur cosmodrome in Kazakhstan and was supposed to fly to the Kura test site in the Russian Far East region of Kamchatka, but the warhead burned up in the atmosphere near its destination (although the newspapers wrote that it had arrived), so the rocket had to be sent for further improvement.

At that time, Mikhail Khrushchev was in power. He wanted to "overtake America", and knowing that the United States was going to launch a satellite into orbit in 1958, he decided to beat them to it. He eventually did as Sergei Korolev urged him to, including a recommendation to use the R-7 to deliver a satellite into orbit. Improved thermal protection was not required, so they pulled out everything unnecessary from the rocket and made the satellite itself, calling it "Sputnik-1".

Initially, the launch of the satellite was scheduled for October 6, 1957, but Korolev demanded that it be made two days earlier. The American report "Satellite Above the Planet" was to be presented in Washington on October 6 as part of the International Geophysical Year meeting on coordinating rocket and satellite launches. Korolev was concerned about it being an announcement of a successful satellite launch and not just a report.

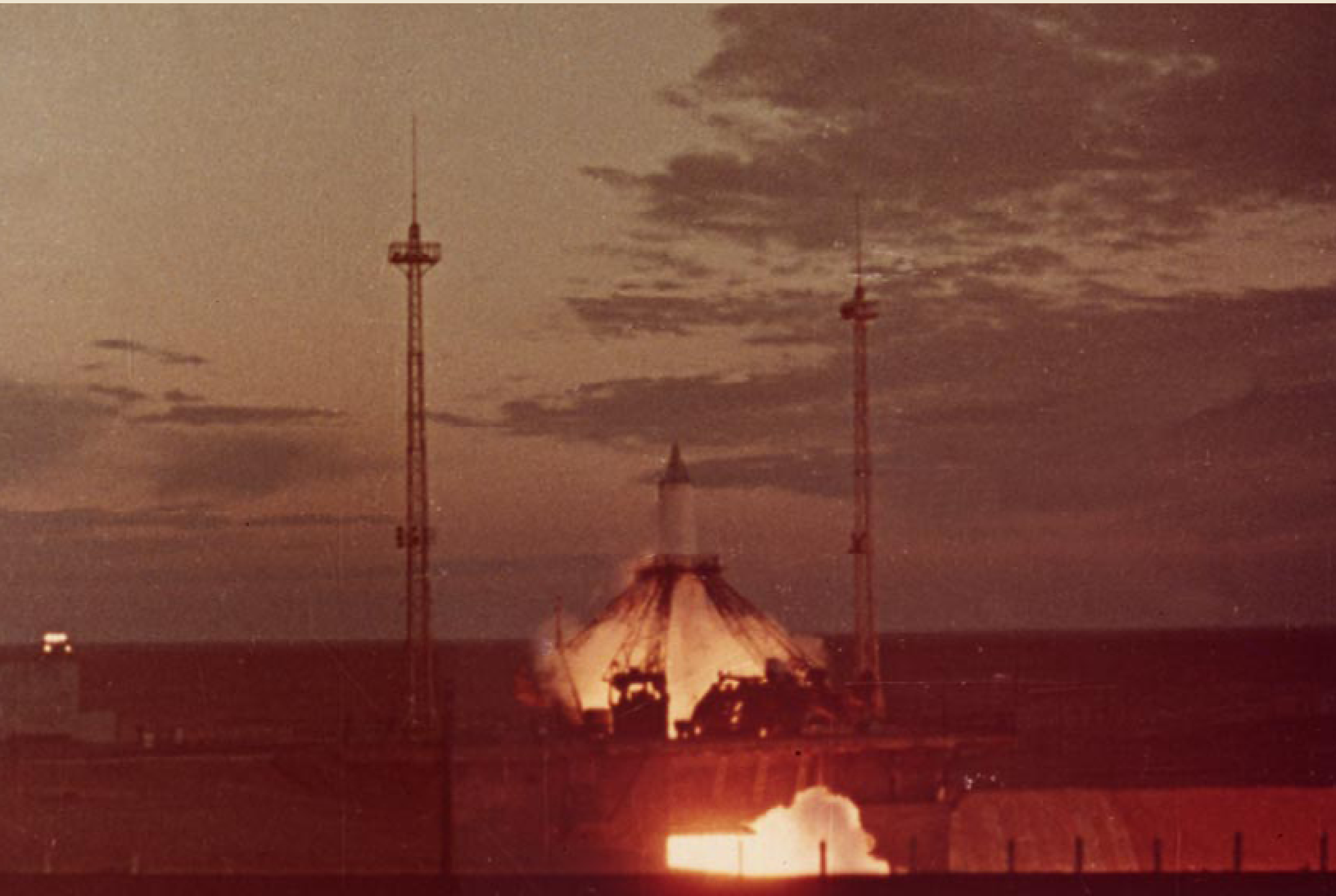
On October 4, 1957, the Soviet satellite "Sputnik-1" went into space—and so humanity entered the space era, so the space race began.

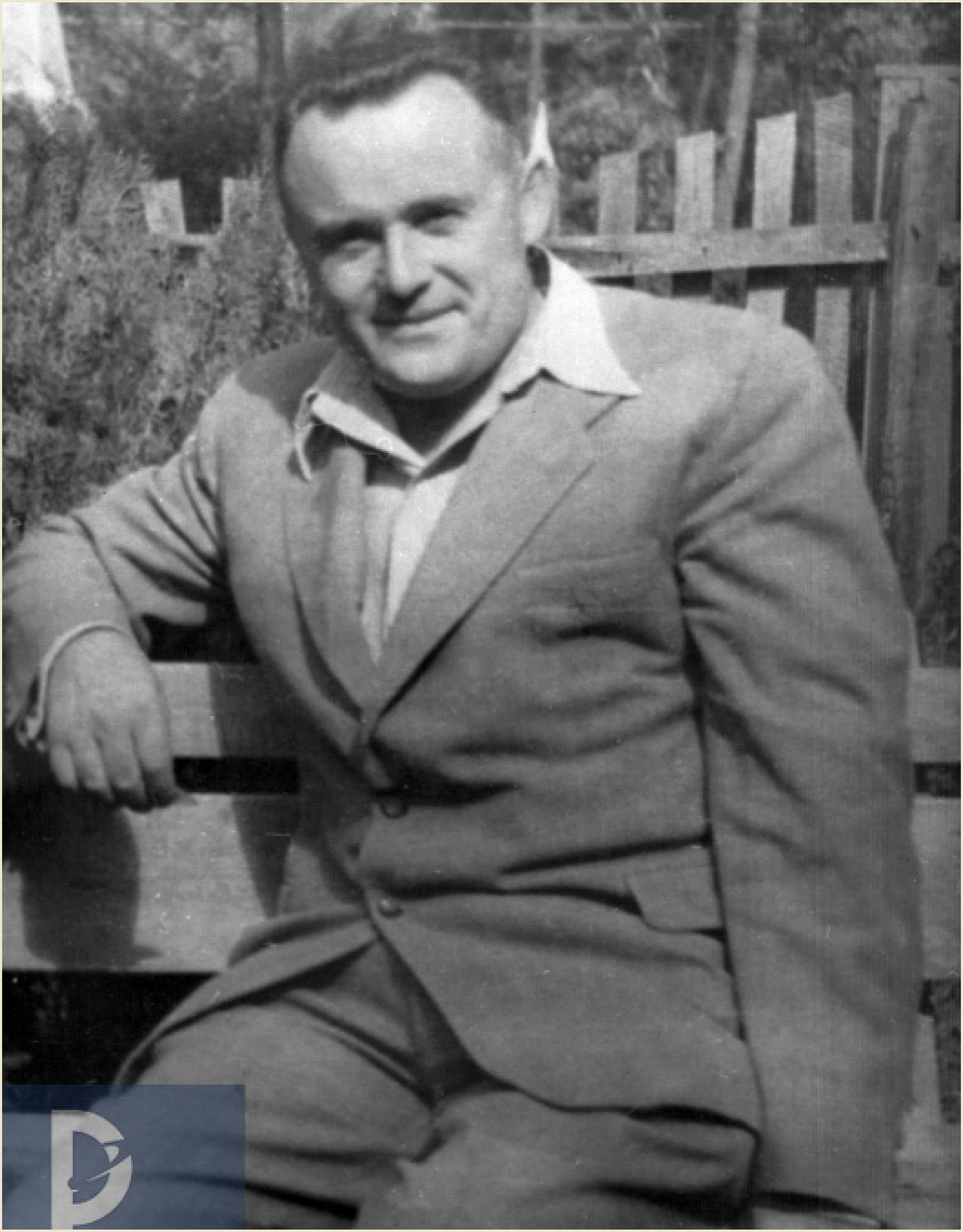
Launch of the R-7 with "Sputnik". Image source. ▶



Cold War Alliances. Image source.
Dark blue: *U.S.A.*
Blue: *other NATO members*
Light Blue: *other U.S. allies*

Dark red: Soviet Union
Red: Soviet satellite states
Light red: other Soviet allies
Yellow: China and its allies





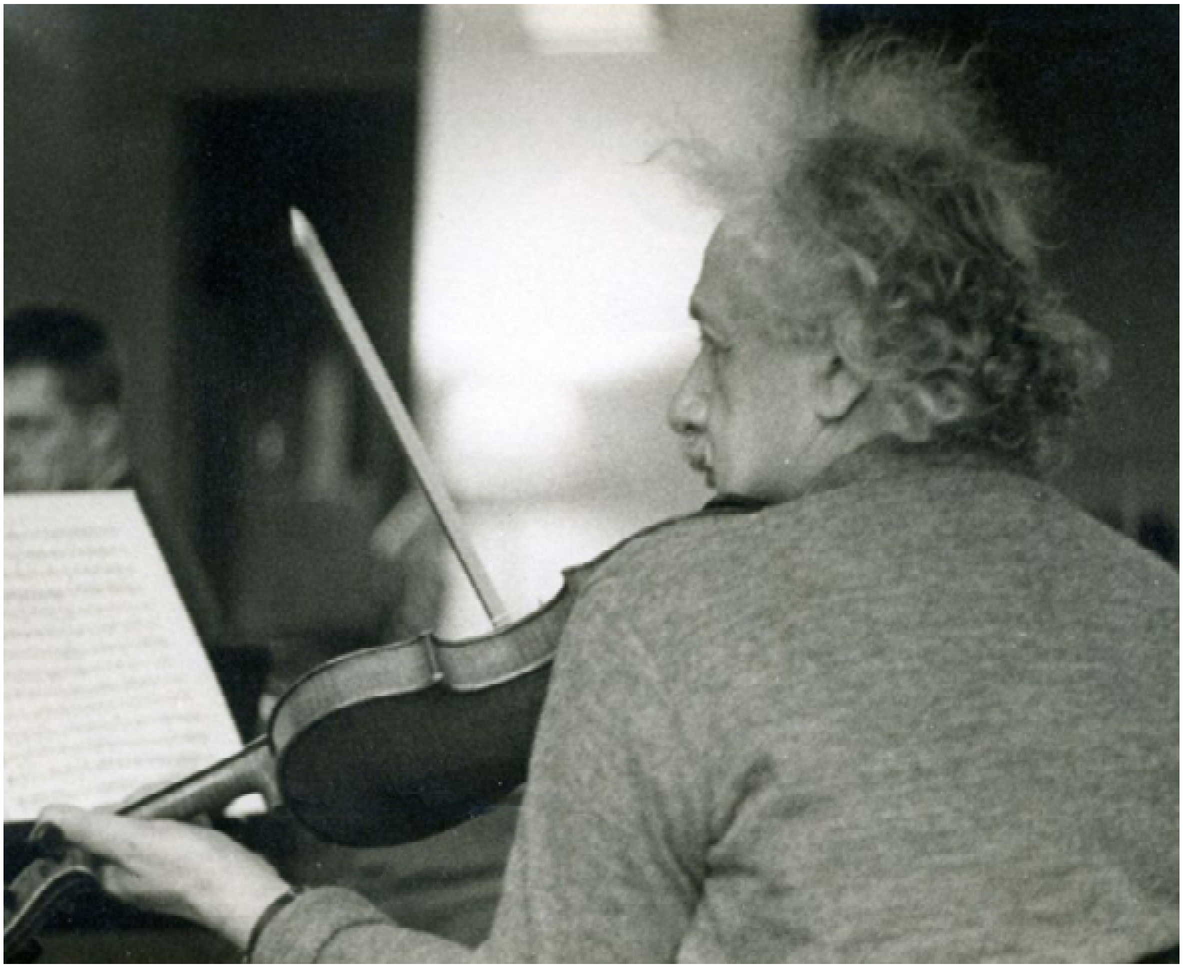
Sergei Pavlovich Korolev, 1957. Image source.

"Sputnik-1", a full-scale model at the National Space Centre (UK). Image source.

"Sputnik – The Beep Heard Round the World" *listen* HERE

String Theory

By Leonid Vishnevskiy



Albert Einstein playing the violin with a small orchestra; Princeton, New Jersey. Image source.

Introduction

In 1905, Albert Einstein came up with his famous Theory of Special Relativity.

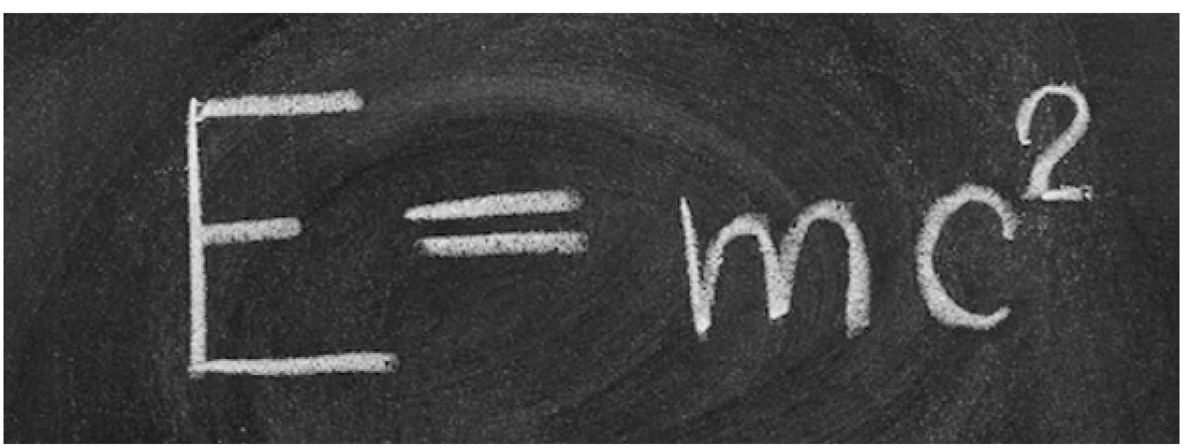


Image source.

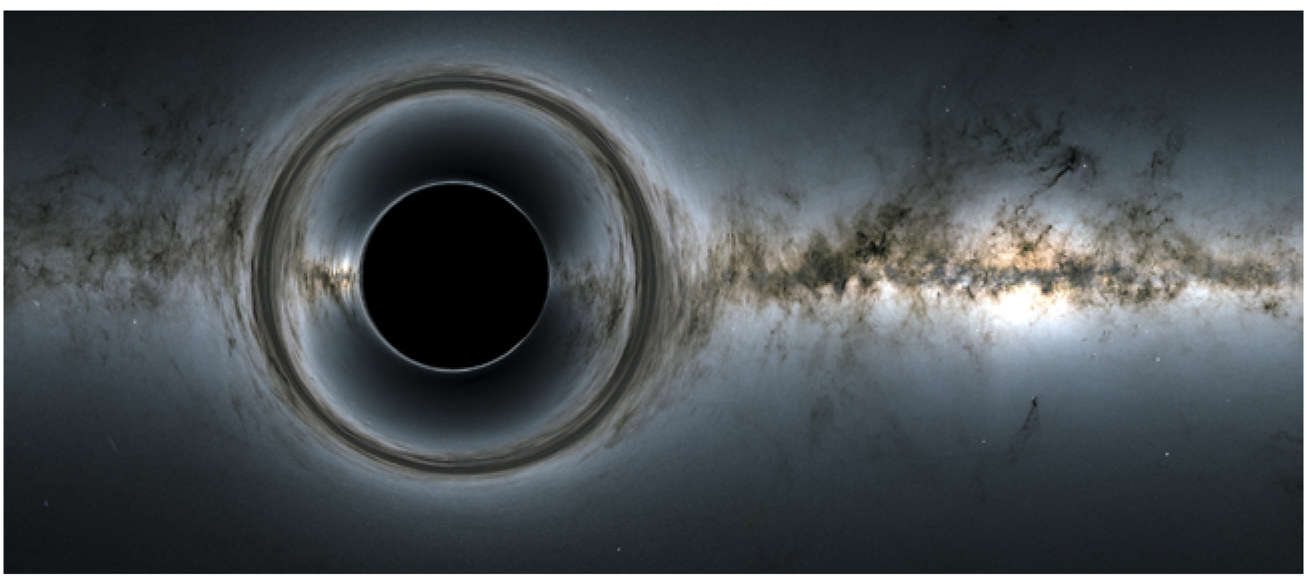
Special Relativity describes how speed affects mass, time, and space. Just 10 years later, he made the Theory of General Relativity, which is what is relevant to this article. The Theory of General Relativity, also known as the Theory of Gravity, describes how *gravity* affects mass, time, and space. These two theories revolutionized physics as we know it.

Isaac Newton was the first to derive equations for gravity, one of the most famous being his Law of Universal Gravitation, created either in 1665 or 1666.

$$F = G\frac{m_1 m_2}{r^2}$$

Let us think of an apple falling from a tree. This law would state that the mass of the apple and the mass of the Earth would both be proportional to the gravitational force, while the square of the distance between the apple and the Earth's core would be inversely proportional to it. That is, the heavier the apple or the Earth, the faster the apple will fall; the closer they are, the faster the apple will fall.

However, the Universal Gravitation law failed to describe some things. It could not predict Mercury's changing orbit around the Sun correctly*, and black holes would be a total mystery when discovered. But even Einstein's laws fail in some respects--they cannot describe black holes, for instance. And the concept of quantum gravity (gravity on a very, very tiny scale) was still unanswered.



A simulation of a supermassive black hole. Image source.

* *The movement of the planet Mercury is described by an anomalous shift of the perihelion (the point where the orbit radius is shortest). The movement of this celestial body turned out to be the first one to defy Newton's law of universal gravitation. When Albert Einstein developed the Theory of General Relativity, the equations of general relativity delivered the value of displacement that was observed.*

The Tiny World and The Standard Model of Particle Physics

Soon quantum mechanics arrived in physics. Quantum mechanics studies the behavior of matter and light at the atomic and subatomic scales. We developed the Standard Model of Particle Physics in the 1970s (with some additions since then, the most recent notable one being the discovery of the Higgs Boson particle in 2012), which paints a view of quantum particles that is shockingly accurate. Still, quantum gravity is not there! There were several other things that the Standard Model was missing.

On July 4, 2012, at the European particle physics lab CERN, scientists announced the discovery of the Higgs boson. Physicist Lyn Evans (standing second from the left), who led construction of the Large Hadron Collider, celebrates alongside former CERN directors. Image source.

One of the most famous examples is the lack of gravity in the Standard Model. While we can explain gravity on a large scale using Einstein's Theory of General Relativity, *both* his theory and the Standard Model fail to predict gravity at small scales. If you try to include strong, quantum (meaning their sources are small) gravitational forces in the Standard Model, you get meaningless infinite loops of gravity.

Another example is the neutrino (also known as "neutrons"). The Standard Model predicts that neutrinos have absolutely no mass. However, experiments have shown that the behavior of neutrinos could only be possible if they have a mass. Albeit they are small, it nonetheless differs from predictions by the Standard Model.

The Theory of Everything

For over half a century, physicists have been in search of a theory that would fix all of this. A so-called “Theory of Everything”. Currently, particles are thought of as points. One consequence of this is that we get the meaningless loops of gravity in the Standard Model, as described earlier. These alternate theories stray away from that conception, stating particles as various different objects. String Theory has had the most success out of all these theories. As you may have guessed, it describes particles as strings. Let us now get into the specifics of string theory.

String theory, as discussed above, states that particles are string-like, not point-like. Each particle has its own vibrational pattern--one pattern describes a photon, another describes a Higgs boson, etc. This easily includes the graviton, the particle that describes gravity. This mathematical elegance and simplicity is one reason why string theory is thought to be correct.

It is important to remember that many modern physics theories, including string theory, are purely mathematical constructs. At this stage in physics, it is difficult to infer conclusions from simple physical observations. Additionally, string theory and other similar theories have not been experimentally proven.

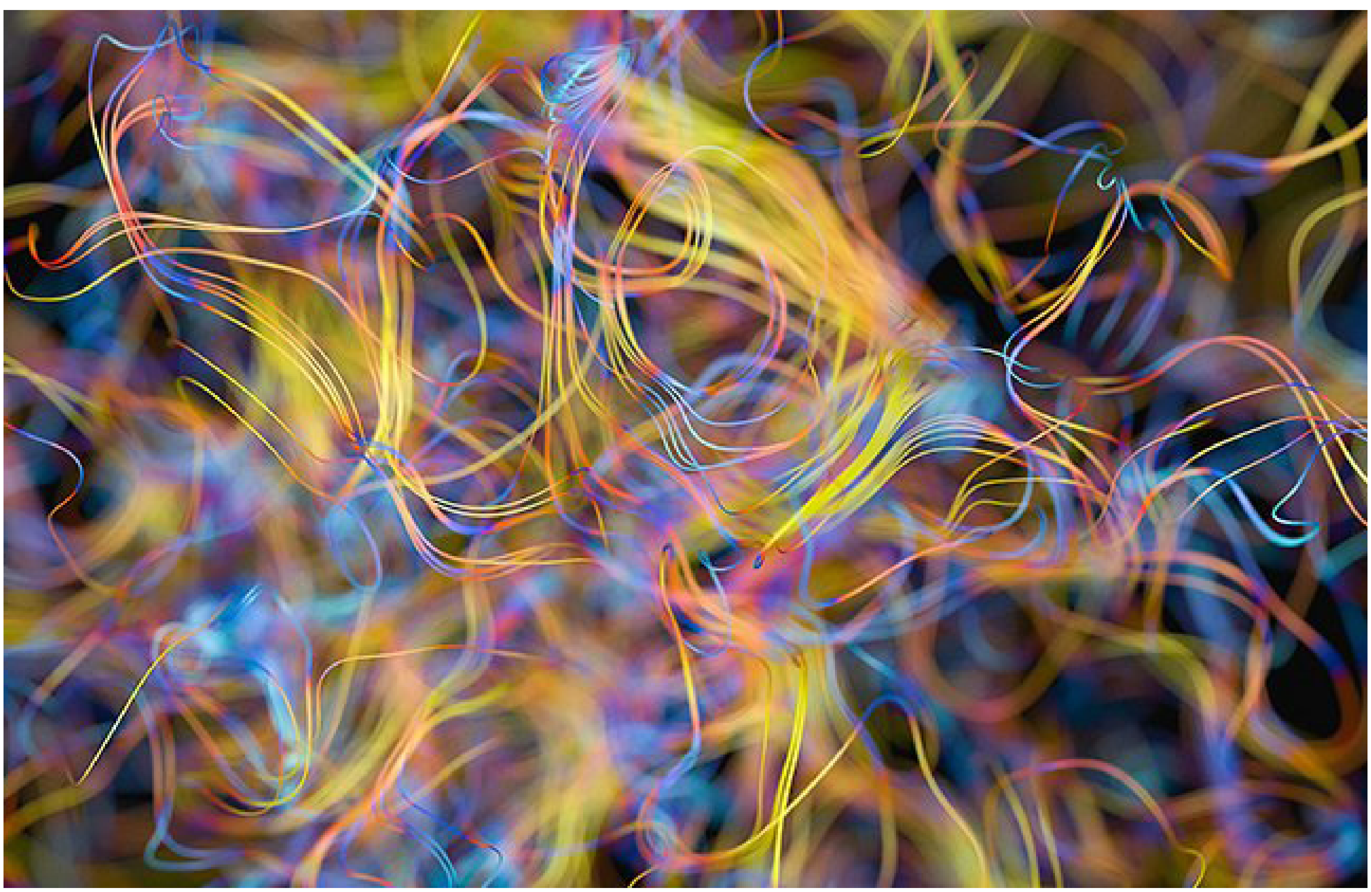


Image source.

The Bosonic String Theory, or 23 Ant Dimensions

The first version was called “bosonic string theory”. It predicted strings close to the size of the Plank Length--the smallest possible length there could be (i.e., nothing can be smaller than one Plank Length). Bosonic string theory ran into some problems, however.

One problem was that it needed a total of 26 dimensions to work. We usually think of the universe as having 3 dimensions, or 4 if we add time. But beyond that? We just don’t know. There are hypotheses out there. One such hypothesis is that these extra dimensions are very, very tiny--we can’t see them. What does that mean though, not seeing a dimension?

One popular analogy is an ant climbing on a pole. You’re standing, say about 50 feet away. To the ant, the pole is 3 dimensional; it can go up, down and loop around. To you, it looks 2 dimensional. The third dimension component is too small for you to observe. And the same here--the extra dimensions may just be too small for us to usually observe.

Now, on a quantum scale. Imagine a massless particle traveling at the speed of light. Go to its perspective. Imagine that it is looping around a very, very small “pole” dimension. Zoom out a bit to go to an observer’s perspective. That pole dimension is no longer visible—we observe the particle to be going straight. Because of that, it appears that the particle is going a bit slower than the speed of light, since it’s actually traveling in two directions, but we only see one direction/component. This *would* mean that it has a little bit of mass. Adding these extra dimensions means that we solve the mass-neutrino problem--it is simply moving in other dimensions, instead of moving in one dimension with mass. However, there is no proof that these dimensions actually exist.

Another major issue is that it only predicts bosonic particles, while there are two groups of particles: bosons, and fermions. Fermions make up all the matter we see around us (they occupy space), while bosons do not occupy space, but rather carry forces. Don’t worry if that doesn’t fully make sense--you’d have to be quite an expert to fully understand that.

One more issue is that it predicts a particle called a ‘tachyon’--these are particles with a mass of √-1, which is an imaginary number (it doesn’t exist--√-1 is another way of saying “what two same numbers multiplied get -1”; that number does not exist) and predicts that this is an unstable particle. This we cannot have as well.

One last issue, which we will not go into detail with here, is that it breaks something known as “conformal anomaly”.

Super String Theory, or a Simpler String World

Then, spinors were added to the formula. Spinors are a complex, mathematical vector object that is hard to explain in quantifiable terms. However, what can be said is that they describe fermions in the Standard Model. Now, fermions were predicted by string theory and tachyons were eliminated. This was named "super string theory".

But two problems still persisted: the problem of dimensions and the problem of conformal anomaly.

Regarding dimensions, however, the problem was simplified. Instead of there being 26 total dimensions, there were now only 10. There is another hypothesis at how these extra dimensions manifest themselves. That hypothesis is that we are in a 3-dimensional space inside of a 9-dimensional universe (one of the 10 dimensions is time, which is not spatial, so we subtract one dimension here). However, as with the other dimension hypothesis (where an ant was used as an analogy), there is no reason for it to be true other than that "it could be".

What stops us from being able to use these 10 dimensions for our calculations? These extra dimensions can manifest, or "curl" themselves in many ways. Using Calabi-Yao manifolds we find that there are 10^{200000} ways! That's 200,000 zeroes! If we had a complete theory of string theory, we could figure out which way it is. Only one way would satisfy our Universe. However, we cannot yet; we are stuck with all these ways.

Image source.

M-theory

Then, came M-theory in 1995. Discovered by Edward Witten, M-theory seeks to unite all the different versions of string theory. Instead of imagining them as conflicting, it brings them all together.

M-theory adds 'branes'. Branes are objects that can be in any existing dimension. A brane can be 1D, 2D, 3D, etc. We are limited to our dimension, but branes are not. To make this work, an 11th dimension must be added. In this theory, these dimensions may be big enough to detect in particle accelerators. Before, they were thought to be 10^{-33} m; now, it is estimated that they are 10^{-16} m. Still quite small, but within our range!

An addition to M-theory came along with the physicist Juan Maldacena in 1997, when he discovered the AdS/CFT correspondence. This connects a string theory operating in a space-time region called anti de Sitter space to a quantum field with one less spatial dimension. Basically, it allows calculations of high-energy systems (like those in which we would use General Relativity) to relate to calculations in quantum spaces. That is, theories like Einstein's General Relativity can be connected to quantum mechanics.

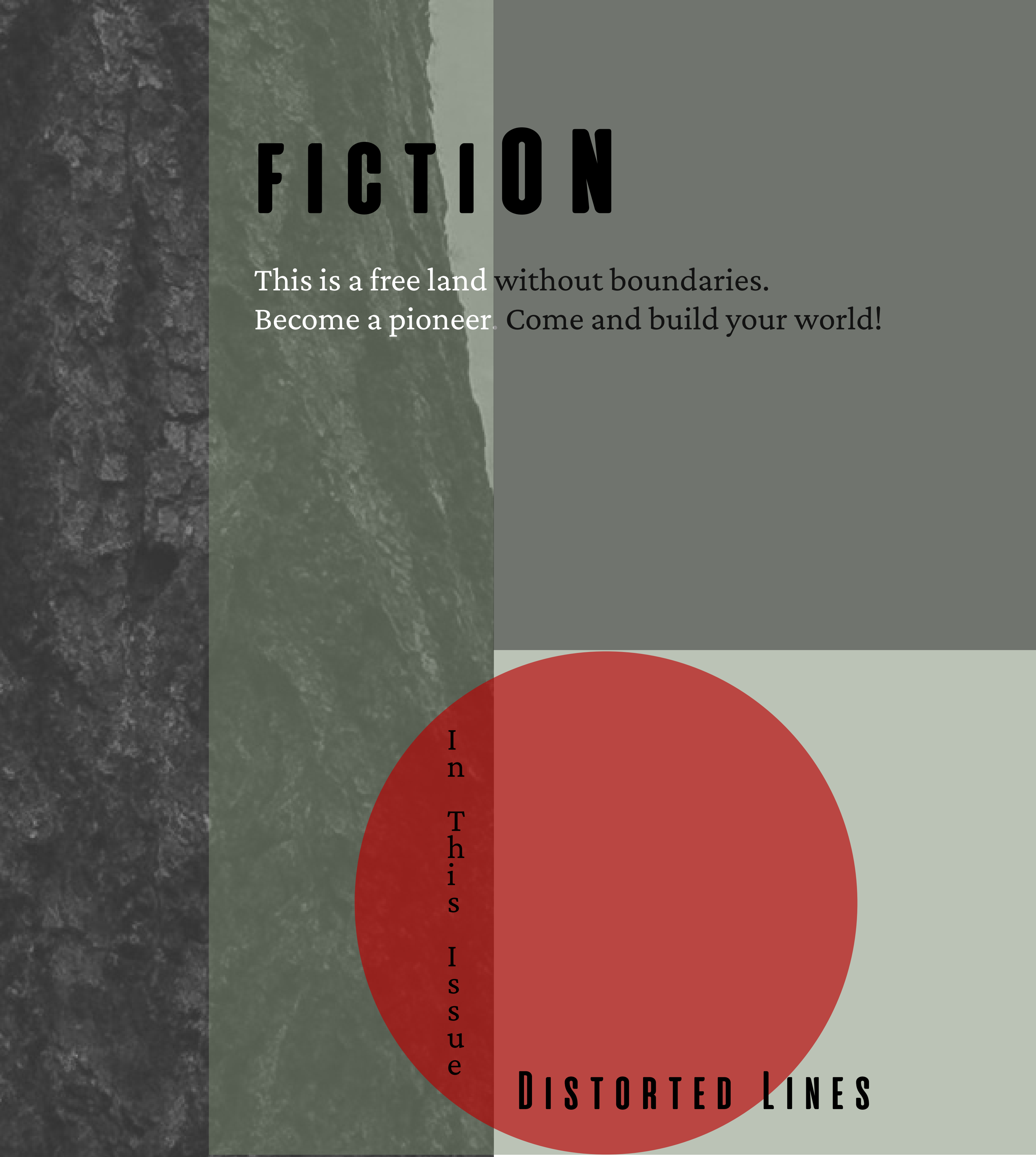
Conclusion

Despite all these breakthroughs, string theory remains very incomplete, and all of these discoveries are "incremental". The future of string theory, whether it is ultimately correct or not, is still a controversial topic of debate among physicists.

But even if it turns out to be untrue, it has uncovered many things in various fields. In mathematics, it made great advancements in differential and algebraical geometry, low-dimensional typology, etc. It gave us a better understanding of the Standard Model. String theory even gives candidates for dark matter--but that too is a topic of debate.

String theory has given us many advancements, and may help us in creating the true "Theory of Everything", or something that would explain and connect all aspects of the Universe.

On the right is an image from Official SpaceX Photos on Flickr, Starship Full Stack.



FICTION

This is a free land without boundaries.
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In This Issue

Distorted Lines

Short Story
by Leonid Vishnevskiy

Collage by Leonid V. Images used are from the public domain including an image by Maxx Gong and by Dave Hoefler from Unsplash.

DISTORTED LINES

by Leonid Vishnevskiy

- Alright class, and that's a wrap. See you tomorrow!

Said the teacher, his virtual face staring at us. We all wrote our goodbyes in the chat, and exited the browser window.

I've attended this online school for all my life. While I've been a straight A student, I haven't excelled at most of these subjects—sure, I'm doing well and can understand them, but my teachers wouldn't be writing me a sparkling letter of recommendation even if their career depended on it. Besides physics. That's where I always excelled above and beyond.

I've had this project of mine since middle school. It's been attempted many times by many people without success, and some aspects of it are thought to be impossible. It's something that maybe everyone has dreamed of, yet also something that might bring unintended consequences. This year, I finally made a breakthrough. It'll be quite a bit before it's done, but the hard part is just about over. This, ladies and gentlemen, is a time machine.

I know you're thinking that it's quite unreal for a 11th grader to make a time machine, while the world's most brilliant minds have declared part of it physically impossible—the part that is theoretically possible is practically unachievable with modern technology though. Probably, I made a mistake somewhere, you may be thinking. I am certain that the machine works, about that there is no worry. Just in what way...have I foreseen all the possible situations that may arise as a result of traveling along time?

Because of my intensive focus on the machine this year though, my grades have dropped quite a bit. I've just...stopped caring for all else. It's too exciting.

***

Archimedes was so thrilled and excited with this discovery that he immediately hopped out of the bath and ran onto the streets to tell the king, shouting loudly 'Eureka! Eureka!' (I have found it! I have found it!), in delight.

This was how I felt the moment I discovered it. The one thing preventing me from completing all the equations. At the beginning of the year, I realized what my logical mistake was. That slightly flawed logic led me to the wrong equations—now that the logic was right, I had begun working on re-making the equations…and I'm done. I had a model for my time machine. The only thing left was to build it.

You may be asking, where do I get the money? The ability to build it? For the money, I run a small business. I started it in 6th grade, but I've started saving all my money from it in 8th grade for precisely this reason. As for building…we'll see. I'm not quite a construction worker, but I can't trust this machine to be with anyone else.

How does time travel work? Very basically, I'll explain. First, you have to imagine time as a dimension. We live in three spatial dimensions and a fourth dimension of time. Say that you were to define your position in the universe as a set of coordinates. You'd have x, y and z, right? But now also add on the dimension of time. Maybe you are sitting in your house right now in 2023—but what if we changed that time coordinate from 2023 to 1900? Maybe your house doesn't exist, and you're hovering above a dusty road. 1500? Maybe a bear is over there, taking a good look at you.

Where an object's spatial position is relative to time is what is called its world line. What my time machine does is go back on the world line of all objects.

***

Finally, it's built. I finished a week ago, but wanted to make sure I got everything right.

I get into the time machine, and start it up. This machine is a spinning sphere, with a chair on the inside (the chair doesn't spin). I hear the sphere whirring. Faster and faster, until everything is a blur. I just have to sit like this for 10 minutes, and then I'll begin traveling. What time have I chosen? 1905, or what is called the "miracle year" for the famous physicist Albert Einstein. His theory of Special Relativity, finished just then, had among many other things stated that time travel to the future is possible. In fact, you're traveling in time right now as you read this. It depends on how fast you are moving—though this time travel is insignificant and unnoticeable unless if you're going close enough to the speed of light.

The color of the sphere is white, but it had some transparent panes on it. Now, they blend into the color of the sphere. It's all so mysterious. My eyes start hurting now from looking at the sphere, always trying to refocus on a certain point.

Eventually, it all looks as though it isn't moving. It's so fast, that my eyes can't tell one second from the next.

It's reaching its critical velocity. This is when it will start traveling back in time—it just has to hit a breaking point.

BANG! The machine makes a sound, and here we go. I can feel the air around me pulsate, as the surroundings change. The chair starts vibrating, and my hands shake ferociously. My head is held in one place by a grip on the chair, but I can feel the pressure for my head to turn. I try to keep my mouth closed, but it starts making noises as my jaw opens and closes. I start getting goosebumps.

BANG! The machine starts whirring down. All is normal, and I am now arriving. Some moments later, the machine arrives.

I've done it. I've actually done it!
I open the door. "Ahhhh!" and immediately fall. I latch on to the first thing I can see.

I landed on top of a tree. Thankfully, I can climb, but this was a rather unwelcome entry into 1905. In any case, at least it works (right?)!

I climb down, and take a look at my surroundings. I see an old brick house, with a smoking chimney. In front of the house is a road, on which a car drives by. It looks surprisingly modern for the time though...it's at least from the 1950s. But anyways, maybe that's just me. I'm not a car expert, after all.

I look back, and see a dirt road. A horse travels by with a carriage attached to it. Suddenly, several people with hunting rifles poke out of the carriage in my direction, and I see their fingers going straight to the trigger! I jump to the right, but it's much too late. I feel my heart pumping. My ears ringing. My body forms goosebumps, and my vision becomes blurry. This is how I'll die. All alone, in 1905. Maybe all time travelers die? Maybe this is their fate?

I look down at my body. I have no injuries. It looks like I'm completely fine. As though nobody ever shot anything. I look again to the house, and nothing is amiss. The horse continues riding until they are out of sight.

I wonder...

I see a lady walking along a road, and next to her is something... I squint harder, until I see it's a bear.

"Bear!"
I shout. She doesn't hear me. I shout again:
"There's a bear behind you! Turn around!"
Once again, no response.

The bear does not notice her or me. It just steadily walks past, and behind a cabin it goes. Interesting.

Once she's walked a bit past it, I start going up to her. As I step on the grass surrounding the road, I feel a change of atmosphere. There's a wind.

- Ma'am, there's a bear behind you!
- Bear!? Where?
- Over there, just behind that cabin.
- What cabin? There hasn't been a building in miles.
- Right there, just to the right!
- There's no cabin. And it is rather impolite to make jokes like this.
- Excuse me, what year is it?
- What?
- What year? Is it 1905?
- Are you trying to play some joke on me? It's 1955. If you'll excuse me, I'll be on my way now.

Strange.

I start slowly walking away, so as to not attract the bear.

I walk like this for a few hundred feet along the road, until it abruptly ends into a forest. Another car is driving by. I wave my hands for it to stop, as the forest is quite thick with vegetation and the driver would certainly be injured if they drove into it.

- STOP!!!

The driver brakes, but they don't fully stop. I close my eyes to spare myself from watching this horrible accident. My oh my, how dreadful of a welcome into this world.

I hear nothing new. I slowly open my eyes and see that the car is gone.

Suddenly, one more car drives, this time out from the forest, right onto the lane I'm standing on. It honks. I stare into its headlights, processing what is happening. Before my brain can react, my legs carry me away to the side, as my elbow hits the curb. The car drives by, and I am alive. Just got away.

However, the car didn't move anything in the forest. It just...drove through it. No leaves rumbled, no animals startled.

I start walking towards the forest, eager yet scared to see what it is that's inside. When I walk in, the atmosphere changes again. The air is suddenly damp, and I hear many animals. I immediately start sweating from the overwhelming heat. As I walk more into the forest, I hear thuds. Louder and louder. Closer and closer. Suddenly, a loud roar like I've never heard before. It scares me, but I continue to move, finally exiting the thick vegetation. I look out upon a large field. I look to my right, and I see an animal. It stares down onto me. It has two legs, and perhaps the most frightening face I've ever seen. Its tiny arms flail about as it opens its mouth, and it starts running right to me.

I stand for a second, once again frozen with fear. My adrenaline makes my legs run.

I run back to the vegetation, with my heart pounding. I run and run, until I suddenly am back on the same road I was on before. No more roars, no more thuds. As I turn back around, I see the animal again. Now I can believe that it is in fact a T-Rex. Knowing there is no escape anymore, I cover my head with my hands in despair. May I live happily ever after in the afterlife, if that does exist.

Why did I get introduced to this world like this? Why is there something resembling a T-Rex here? Is all of history wrong? Or is this the fate that entails all time travelers?

As my brain asks all these questions, I realize that means I'm alive. I peek out; the T-Rex is gone.

Did I really just see a prehistoric animal? I guess that I will never know. At least I know I'm alive.

I look to my left, and I see sand, with a vast ocean behind. I make my way slowly through a couple bushes, and here I am. I'm on a beach. In front of me runs a child with a beach ball, joyfully playing with his friends.

But as he turns towards me for a moment, I notice his odd eyes. They don't look... human. Surrounded by metallic gears, there is a red pupil in their center.

"You look weird!" he says. I'm inclined to reply, but I'm just noticing how much unusual there is about him.

"What year is it?" I ask.
The boy turns towards me, and in a very monotone, serious voice he says:
"The year is 2623 in the Gregorian Calendar."

Then, he keeps playing. Strange, I think. I look back behind me, but the bushes I passed through are gone. Now there's a city street. Except...it's not quite like one in 1905. Or in 2023. The roads are empty, only buildings are present. I walk onto the street. Huh.

The air changes again. It's quite dry, but also quite clean. The temperature could use some work though, I'm a bit hot. When I look up, I see cars. Many cars. Are they...flying? Suddenly, I hear the wail of a police car's sirens, and the sound of its brakes. I look back, and I see the car.

"I'm going to have to give you a ticket for standing in emergency lanes, sir. Please show me your ID." The officer says. I didn't even see him approach me, so I am initially startled.
"Sure thing, one second..."
It seems that not all the cars fly.
"Here, officer."
The officer takes a quick look at it.
"This ID expired 2,000 years ago. It looks like a toy, frankly. Do you have your real ID with you?" The officer lets me take a look at it, and I notice nothing is wrong on it.
"Yes, officer, this ID expires in 2028."
"Alright, where's your ID?"

"I swear, that's my ID."
"Name, please."
"John Parker."

His eyes suddenly stare just above me, and he is expressionless. A few seconds later, he looks back to me. Isn't he going to search my name?

"Alright, I'm giving you one last chance. What is your name?"
"John Parker."
"That name doesn't exist. Give me your name, or else you are under arrest."
"Officer, I swear it's John Parker. I live at Melbury Drive in Maine, my parents' names are Mary and Ters."
"I don't want to do this to you—just give me your name."
"John Parker!"
"The John Parker you describe went missing long ago. Impersonation is a serious crime, 'Parker'. You're under arrest for failure to comply with an officer and impersonation."

I run, but he immediately grabs my hands. I try to shake him off, but he's too strong. Strange thing is, all my struggling does not move his hands at all. They are of a robotic strength, in a way. He puts me in his car, and we drive. Just a hundred feet away, I see an enormous pyramid in the desert. How is the desert right here? As we drive closer and closer, I alert the officer.

"There's no pyramid or desert, John Parker." The officer says with a slight smirk.

We're not slowing down. I brace myself to be driven up a dune, since the angle is quite steep. I put my head down, and cover it with my hands. Nothing happens. No shaking, no new sounds. I uncover my head. I'm kneeling on desert dunes. I look all around, and the police car is nowhere in sight.

The air is dusty, it is windy. I feel little pellets of sand flying into my face. I squint my eyes, put my hands horizontally on my forehead, and march forward, head looking down. I eventually reach the first steps of the pyramid. As I do, someone yells something incoherent at me.

"What!?" I yell back.

Once again, they yell, but I can't understand. I look and see a man in a blue robe approaching me. He starts walking faster and faster, until he is running. His hand leans back, and I notice what it is holding—a spear. Filled with fear, I start running back up the dune. I hear the spear just miss my ear as it lands in the sand beside me. I reach the top, and slide back down into the futuristic city. Hopefully, neither that man nor a cop will find me.

I run towards the beach where I was at before, and then I hear a siren. There's a cop car behind me. I accelerate my pace, almost running out of breath, but as I glance back, I realize I won't make it. The car is too close.

I notice that I am running past buildings. As I run next to one of them, I think to myself, "what if I scale this building?" Maybe it'll be unsuccessful, but it's a better option than trying to outrun a speeding car. I turn immediately, almost sliding, as I cross the street towards the building. Just as I'm about to reach it, something bright shines at my side. For a half-second, I glance—the car's headlights are right by my feet. This is how I will die. I know I've said it before, but now death is a foot away, not 50 or 100. It will happen. Goodbye, world.

I feel pain, almost like a very rough slap, on my neck. This is it. My legacy is ruining the space-time continuum, and being rammed by a cop car 2,000 years from my time. I feel my legs bleeding.

"Albert, wake up already!" I hear a voice say.
"Huh?"
"Albert, sleeping is not acceptable at this time. See me after please."

I open my eyes, and start shivering. I look up, and an adult's face glares down at me. I look behind, and someone is holding a bucket. I realize I have cold water on myself, running down my body.

"Sorry…what?"
"Exactly. Wake up now, we've got a lot to cover in class today."
"Alright…"
I realize where I am. I'm at school. It was all a daydream. Thank goodness!

My mind still half-asleep, I take a look at the chalkboard. After a short grunt, I rub my eyes and refocus them. Then, I read it:

"February 3, 1895."

The End

OUT

The Hill That Dug Itself

Send your surreal collages, drawings, paintings, or photos.

The name of this rubric is "The Hill That Dug Itself Out."

On the left is an image by Kristaps Ungurs from Unsplash.

"A Cosmic Tarantula, Caught by NASA's Webb"

Excerpts from the article at nasa.gov

When looking at the collage to your right, please turn THIS music on, "Curtain Is Closing" from "Keeper Is the Heart" by Nighttime.

"Once upon a space-time, a cosmic creation story unfolded: Thousands of never-before-seen young stars spotted in a stellar nursery called 30 Doradus, captured by NASA's James Webb Space Telescope. Nicknamed the Tarantula Nebula for the appearance of its dusty filaments in previous telescope images, the nebula has long been a favorite for astronomers studying star formation.

At only 161,000 light-years away in the Large Magellanic Cloud galaxy, the Tarantula Nebula is the largest and brightest star-forming region in the Local Group, the galaxies nearest our Milky Way. It is home to the hottest, most massive stars known.

One of the reasons the Tarantula Nebula is interesting to astronomers is that the nebula has a similar type of chemical composition as the gigantic star-forming regions observed at the universe's "cosmic noon," when the cosmos was only a few billion years old and star formation was at its peak. Star-forming regions in our Milky Way galaxy are not producing stars at the same furious rate as the Tarantula Nebula, and have a different chemical composition. This makes the Tarantula the closest (i.e., easiest to see in detail) example of what was happening in the universe as it reached its brilliant high noon.

Despite humanity's thousands of years of stargazing, the star-formation process still holds many mysteries – many of them due to our previous inability to get crisp images of what was happening behind the thick clouds of stellar nurseries. Webb has already begun revealing a universe never seen before, and is only getting started on rewriting the stellar creation story."

Collage by Leonid Vishnevskiy. Images used are from the public domain including the image "Children of Andre de Laboulaye" and the image Tarantula Nebula (NIRCam Image) by NASA, ESA, CSA, STScI, Webb ERO Production Team.

"Discovery of the Circle"

Excerpts from the book "Discovery of the Circle" by Bruno Munari.

"While the square is closely connected with man and his constructions, with architecture, building forms, lettering, etc., the circle is related to the divine: since ancient times a simple circle has represented eternity, for it has neither beginning nor end. An old text says that God is a circle whose center is everywhere, but whose circumference is nowhere.

The circle is essentially a dynamic figure: it is the basis of all rotary movements, of all vain searches for perpetual motion.

Although it is the simplest of all curves, the circle is considered by mathematicians to be a polygon with an infinite number of sides. Take away an invisible point from the circumference of a circle and it is not a circle anymore, but a *pathocircle* which represents complicated problems. A point marked on the circumference of a circle eliminates the idea of eternity by indicating a beginning, and therefore an end, to the circumference itself."

Collage by Leonid Vishnevskiy. Images used are from the public domain including an image by Dwinanda Nurhanif Mujito *and by* Salvatore Andrea Santacroce *from Unsplash.*

Image source

About Impressions

A review suggests an objective view aiming to be impersonal to a certain degree, meant not to share your favorite movie or book (in fact the reviewer could dislike the movie/book he is writing about), but rather to rate the movie/book. Astra News suggests to you a free hand of writing reviews, meant to share what you like, in which you set your criteria.

Impressions

In This Issue

Impression of the movie "Moon" (2009) directed by Duncan Jones.

Please note that the movie is rated R. We adjusted the impression to fit the magazine's younger teen audience.

MOON

Movie impression by Leonid Vishnevskiy

All About the Moon, 1969

The movie "Moon" is a 2009 British science fiction drama film directed by Duncan Jones and written by Nathan Parker based on Jones's story.

Jones is the son of David Bowie. Of course, David Bowie needs no introduction, but it was not always so. He became well-known in 1969 when his song "Space Oddity" reached the top five on the British Hit Parade. Among other things, the song was greatly inspired by the movie "2001: A Space Odyssey" by Stanley Kubrick, which Bowie had watched many times.

David Bowie at the studio of artist Dante Leonard in 1969. Image source.

In "Space Oddity", Bowie told a story about a fictional astronaut named Major Tom. His departure and operation began successfully, but then he became lost in space. He is begging ground control to tell his wife that he loves her very much, because he knows he will never see her again.

I am sitting in a tin can
Far above the world
Planet Earth is blue
And there's nothing I can do

The song was released five days before NASA launched Apollo 11 to the Moon, and was immediately banned on BBC in the UK. It still made it to the public though. BBC then played the track over footage of the Moon landing. Later, Bowie commented on the situation, saying, "Obviously, some BBC official said, 'Oh, right then, that space song, Major Tom, blah blah blah, that'll be great. 'Um, but he gets stranded in space, sir.' Nobody had the heart to tell the producer that."

While Bowie is almost certainly correct, it's heartening to think that some music fans mustered the courage to defy the national broadcaster's ban. But after the Apollo 11 mission proved to be a huge success, the ban was lifted, and "Space Oddity" became a top-five hit in the UK and gradually gained large popularity among the American public.

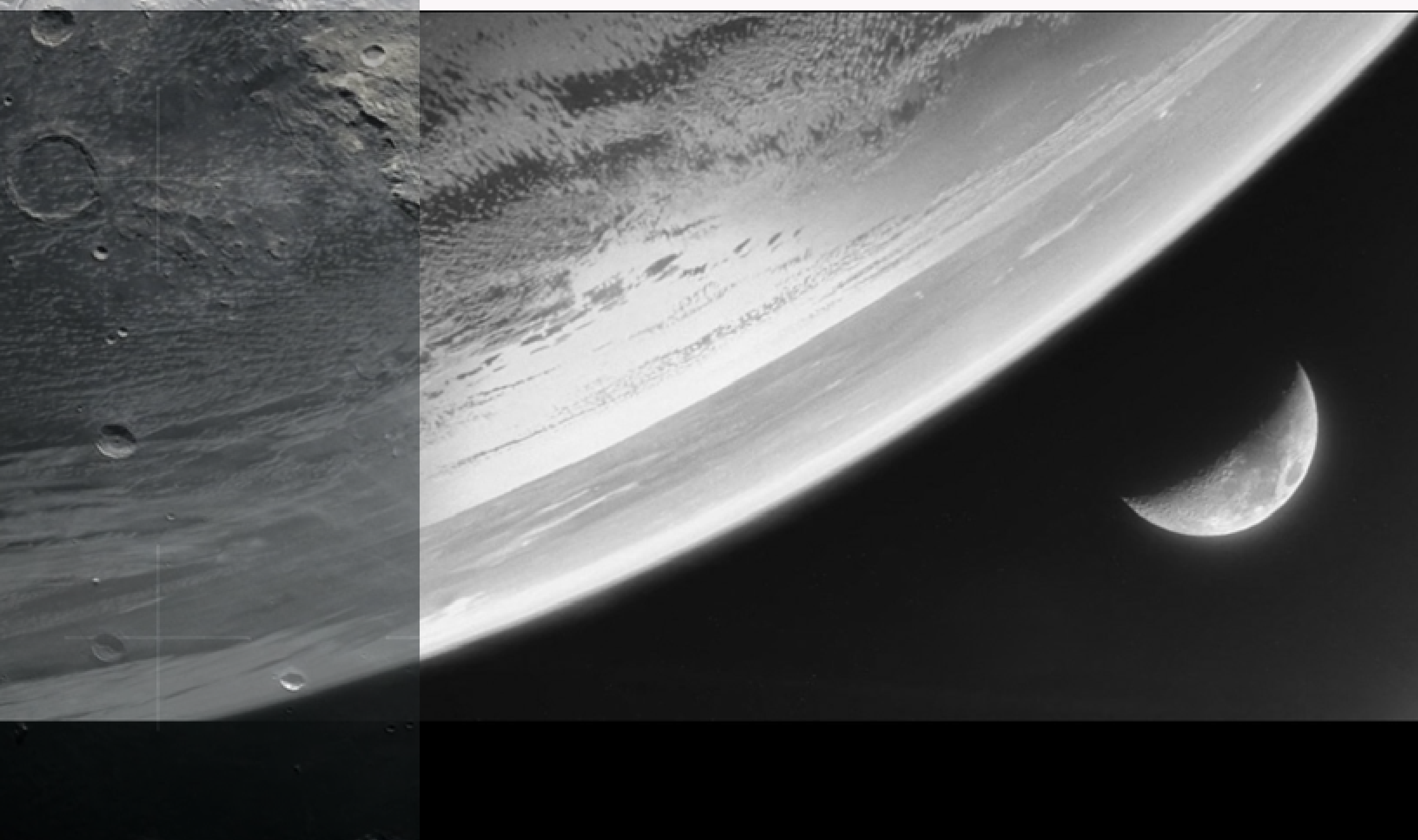
Despite not being heard in "Moon," this song is still there as evidenced by the story the movie tells - a never-ending journey of Sam Bell, the main character, centered on the love he has for his wife, where "*Earth is blue and there is nothing [he] can do*."

However, this is only one perspective of the film; there are others. This film, which was shot in 33 days, is also one of the best examples of quick and low-budget production.

Tess, Sam Bell's wife. An image from the movie "Moon".

"Moon" (2009) Plot Summary

Sam Bell's contract is coming to an end: he has spent three years on the Moon, monitoring an automated helium-3 mining base, a fuel used on Earth. The base's name, Sarang, is the Korean word for "love". Sam is alone there, except for the computer GERTY 3000, which serves as his companion and helper. Although communication with Earth has long been lost, video messages from his wife Tess continue to come. Two weeks before the flight back to Earth, an accident occurs. Sam soon discovers that he is not the only living being on the Moon.



More About "Moon"

The movie takes a while to get going, but once you've watched enough of it, it starts to get quite interesting, especially towards the end.

Here, there are numerous allusions to Stanley Kubrick's "2001: A Space Odyssey." The movie does not continue "A Space Odyssey," even though it is set in the year 2035, especially since some references are made in jest. Kubrick's film rather helps to incorporate the mood created by it, but in a trivial setting, to pose questions such as "What are emotions? What emotions do we consider genuine? Where, if anywhere, should artificial intelligence be limited? ", in a concise manner.

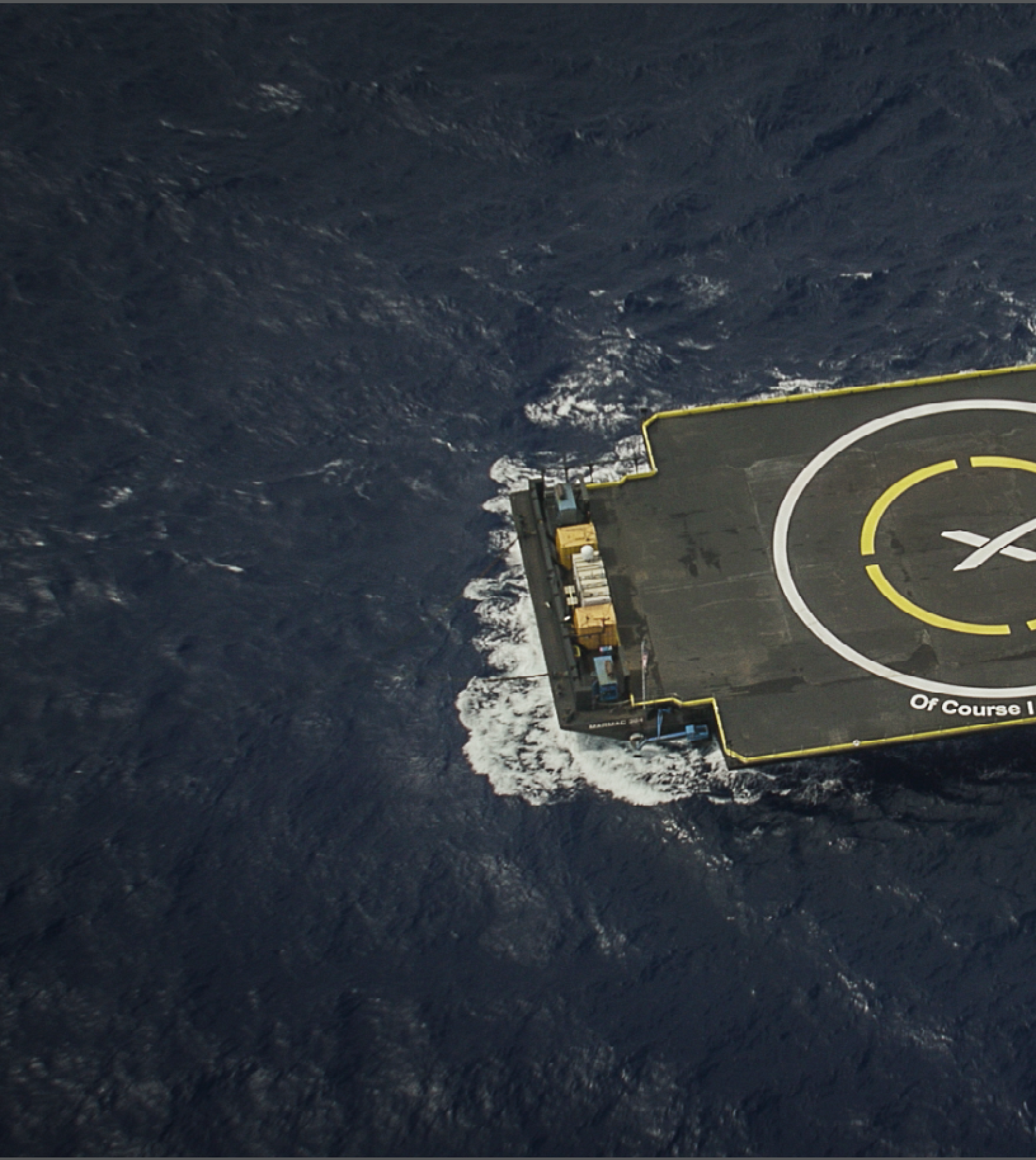
To avoid spoilers, I will not mention the film's other key themes.

The R rating for the film is unfortunate. Even if certain scenes may be shot differently for the better and to broaden the film's audience (PG), this, in my opinion, is still not trully justified.

I think it is a great film and well worth watching.

Images on pages 50-51 are from the movie "Moon".

The end


Of Course I

From SpaceX's archive. "Of Course I Still Love You" *drone ship moving into position for Sunday's rocket landing attempt (2015). An* image *from Official SpaceX Photos on Flickr.*