ASTRA NEWS

11th issue

04.29.22

Hello everyone!

Welcome to the eleventh issue of Astra News!

This issue is dedicated to those who follow what they believe in, expand our horizons and make dreams come true.

Each time has its distinguished man of this kind. For our time, I say “Mars”, and you know his name, I say “multiplanetary species”, “artificial intelligence” and you know his name; and that’s only to name a few.

As always, there are predecessors. With this issue we are starting a series of stories about people who took their part in exploring space. Some of them will be well known, some others less. This series will be called The Vitruvian Man.

Would you agree that when we close our eyes at night and see dreams, we do not immerse into darkness? But did you also notice that upon closing our eyes at any time, we never immerse into darkness?

Close your eyes right now, and you will see iridescent tunnels and circles, especially if you press on them slightly. Then imagine going deep into a forest at night and opening your eyes widely. I assure you; complete darkness will wrap you into itself. To escape it, strangely you will need to close your eyes.

I think that it’s an intriguing philosophical phenomenon. Next time when you are far away from city lights, experience it for yourself.

The cover for this issue not only illustrates this phenomenon, but most importantly expresses the idea that great things lie within ourselves when we are brave enough to follow what we believe in.

Enjoy the eleventh issue!

Yours,
Leonid

The cover for this issue was designed by Leonid V.

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On the left is an image from SpaceX's Flickr

THE REPUBLIC OF MARS

About the Republic of Mars

If you dream of us, humans, to become a multi - planetary species and see Mars as our chance to build a better world for humankind, this project is for you. Please, see the beginning of this project in issues No. 1, 3, 6, 8, 9, and 10.

Pages 4 - 11

In this issue

You have already met Alexander Buick in the previous issue of *Astra News*, where he wrote an article “Future Space Exploration Missions”.

Alexander is not only very knowledgeable about space, but he builds rockets.
In this issue Alexander shares his experience about building a rocket control panel. Rocket launches are shown so much now that we, as the general public, might stop thinking of their design and consider them standard. However, they are intricate, and took different forms as they were being invented.

See the video of Alexander’s rocket launch!

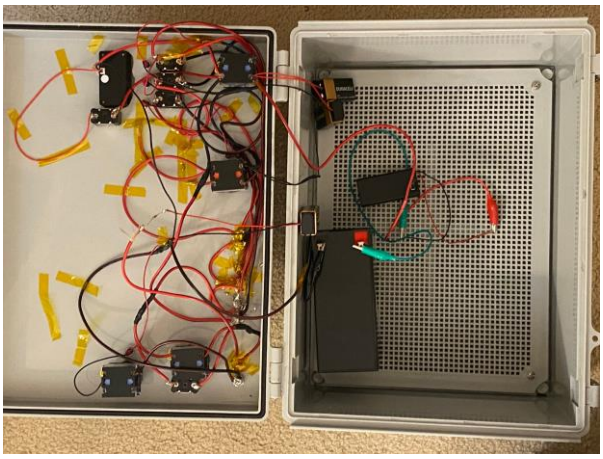
Alexander’s article is followed by “Tsiolkovsky rocket equation and the mystery of rocket flight”. Here, we discuss how rockets propel themselves in space and how we should apply that propulsion using the rocket equation.

On the left is a collage by Leonid Vishnevskiy, using part of the image “First flight, December 17, 1903” and the image taken by the Mars Curiosity rover

Alexander's Rocketry

By Alexander Buick

Over spring break I built a rocket control panel that ignites rockets that I make. Here is how the control panel works. To ignite a model rocket, I attach a wire to the power out to ignite a model rocket. That is where the power will flow to the rocket igniter to ignite it. Then to turn the control panel on, I turn the power key. On the control panel, there is a display that tells me the voltage of the battery as well as the battery percentage. Voltage is helpful to know whether I have enough voltage to ignite the igniter. Proceeding further, you may notice the switches and outputs labeled Panel. The concept behind these is that they can be connected to other control panels to allow multiple people to launch the same rocket. All the additional control panels have to have is some way to turn on and off the current and just needs to be connected. If all control panels are pressing ignite, it will allow current to flow to the rocket igniter. You may notice the switches labeled Panel. These are to complete the circuit if you don't have other control panels and people to ignite the same rocket.



The next part of the rocket is the Continuity indicator. It tells me if the igniter is correctly connected to the control panel by running a low voltage current through it that is low enough to not enough to ignite it but is enough to turn on a light indicating everything is connected correctly. The last step is the ignition button/switch both of these can be used to ignite the igniter on preference. Finally, you may have noticed the emergency stop button. The purpose of this is that it shuts power off to the whole system in the event of an emergency, such as someone being too close to the rocket. To solder, the entire system took about 12 hours. The system is made from an ABS plastic electrical box and parts I found on Amazon. It took a couple of days to assemble the system and a few weeks to design the panel and find all the parts. This system works for any rocket that uses electricity as part of its ignition system. In this case, I was using it for Estes igniters.

By Alexander Buick

End Results

The control panel was successful in igniting the rockets that I built. I was able to put a camera and an altimeter on a rocket. The rocket reached a total of 1200ft in altitude and was powered off of an Estes motor. I was able to get the rocket and motor at a craft store. The rocket camera and altimeter I got off of amazon. I was able to tape the camera on and connect the altimeter to the tether connecting the nosecone to the rocket. Unfortunately, I had a catastrophic failure on the launch day with a different rocket with side boosters. Upon examination of the crash, it was revealed that the cause was that not all the igniters ignited.

Video from camera on the rocket:
https://youtu.be/njvHdxSDgsc

Video of rocket:
https://youtube.com/shorts/8-OHAmnV9P8?feature=share

Video of the launch failure:
https://youtube.com/shorts/yhzDurxoObc?feature=share

Tsiolkovsky rocket equation and the mystery of rocket flight

by Leonid Vishnevskiy

First, we had thought that flight for humans was impossible. Then, we tried to make wings and fly using them. When that didn't work, we created balloons filled with gases. Hot air balloons, blimps, zeppelins we would call them[1]. Hot air balloons worked by heating up the air inside of them, and since hot air is lighter than cold air, the balloon would rise. Blimps and zeppelins were filled with *other* lighter gases than air, and their structures were different. The difference between blimps and zeppelins is that blimps had their "fuel tank's" shape only be supported by the pressure of the gases, while zeppelins had structural frameworks there.

But we needed something faster and that could be controlled better. The idea came of creating a "bird" that we could climb into. That became what we now call planes.

The first planes had fans on their front, pushing onto the atmosphere to generate thrust. Because of the curved shape and angle of the wings, the wings directed air molecules to hit the bottom of the wings more often than their top, "pushing" the plane upwards. This is the lift force. However, in space there is no air or anything to push on. That would make both thrust and lift impossible to generate in space.

Now, we have already launched countless rockets into space. And we couldn't have done it without the Tsiolkovsky rocket equation[2].

Imagine that we want to launch a rocket into space. As you know, gravity and air resistance resist the launch of rockets into space. Also, you know that if you drop a hammer and a feather on Earth, the hammer will drop much faster to the ground than the feather will. You may think that this is because the hammer is heavier than the feather. While the hammer's mass is greater than that of the feather's, if you drop them on the Moon, they will reach the ground at the same time. This could sound like nonsense—but gravity makes them fall the same, even here on

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[1] By the way, a general name for blimps, zeppelins and other air vehicles of that type is dirigible (also known as airships). Hot air balloons are airships when their flight path could be controlled (e.g., using engines and rudders).

[2] "The equation is named after Russian scientist Konstantin Tsiolkovsky who independently derived it and published it in his 1903 work. While the derivation of the rocket equation is a straightforward calculus exercise, Tsiolkovsky is honored as being the first to apply it to the question of whether rockets could achieve speeds necessary for space travel.

The equation had been derived earlier by the British mathematician William Moore in 1810 and later published in a separate book in 1813. Robert Goddard in the USA independently developed the equation in 1912 when he began his research to improve rocket engines for possible space flight. Hermann Oberth in Europe independently derived the equation about 1920 as he studied the feasibility of space travel." Source: https://en.wikipedia.org/wiki/Tsiolkovsky_rocket_equation

Earth! It's just the air resistance that makes them fall differently on Earth (on the Moon, there is little to no air). Also, mass does not affect gravitational acceleration.

By the way, it would probably be useful to understand the difference between mass and weight. Usually, we use the terms interchangeably in everyday life, but that can cause confusion here.

So, as is shown on the Moon in the experiment performed by members of the Apollo 15 mission, mass does not affect gravitational acceleration. While mass does not affect gravitational acceleration, but it does affect how fast the fuel of the rocket can make it go.

Let's fly back to Earth.

To escape Earth's gravitational field, we need to get to Earth's escape velocity, which is about 11km/s upwards. At that velocity, we will be able to escape Earth before gravity lowers the velocity to zero and drop us back down. This is because gravity has an acceleration (though it changes with height) of $9.81 m/s^2$ (meaning meters per second per second, that is, every *second* your speed of *meters per second* is changed by 9.81). This acceleration that is directed downwards lowers our velocity.

To get to Earth's escape velocity, we need very special wings; fuel. And now we need to account for mass, as even though it does not affect gravitational acceleration, a higher mass requires a higher force to move it at the same acceleration. The Tsiolkovsky rocket equation is what helps us here. If before we thought of what kind of wings we need for airplanes, then now we need to think of how much fuel we need for rockets. With this formula we can figure out how much fuel we need to propel our rocket into space and navigate around there.

The Tsiolkovsky rocket equation relates the change in velocity to the fuel ejected from out of the rocket. The fuel ejected from out of the rocket makes it go forward (why this happens will be explained).

However, it turns out that we would need too much of our rocket to just be fuel. To make this percentage less, we add stages to rockets. When one stage has burned through its fuel, we remove it. All that stage would have left us while being fuel-empty is just the mass of the metal and any parts used to make that stage. Once we remove it, we need less fuel to propel our rocket to the velocity that we want to.

So, the Tsiolkovsky rocket equation relates the change in velocity of a rocket to the mass of the fuel ejected. Specifically, the equation is:

$$\Delta v = v_e \ln \frac{m_0}{m_f}$$

Velocity is the same as speed, except that velocity takes into account direction (e.g., let's say an object is moving 50km/h to the left, then its speed would be 50km/h, while its velocity would be -50km/h as a general rule, or sometimes +50km/h [then to the right it would be -50km/h])

Where Δv is the change in velocity of the rocket, v_e is the velocity at which the fuel was ejected from the rocket, m_0 is the initial mass of the rocket (including the fuel), and m_f is the mass of the rocket after the fuel (that is, part of it) was ejected. ln is the natural logarithm.

That little triangle Δ that you see is the delta symbol, meaning "change in".

Ok. Now, we are in space. Thank you, Tsiolkovsky! You may be asking; how *does* the rocket propel itself in space? Here comes the law of conservation of momentum.

The law of conservation of momentum is "the principle that the total linear or angular momentum in any isolated system is constant, provided that no external force is applied". In other words, momentum is constant when there are no external forces acting on the system.

We can assume that there are no external forces acting on the rocket and the fuel. We can consider them to be one isolated system. The fuel being ejected from the rocket is not an external force (as long as it is done by the system's [rocket and fuel] own forces, not by an external force).

The equation for momentum is mv. Let's call the rocket's mass (without the fuel) m_r, and its velocity v_r. For the fuel, let's call its mass m_f and its velocity v_f. Let's call their total mass m, and their total velocity v.

To get the momentum of them both (i.e., of the system), we need to add together each of their momentums.

So, for their total momentum we get this:

$$m_r v_r + m_f v_f = mv$$

Both of their velocities start off from zero, so we get

$$m_r * 0 + m_f * 0 = mv$$

$$0 + 0 = 0$$

In an isolated system, which we are assuming this is, the momentum has to always be constant. That means that the sum of the momentum of the rocket and the momentum of the fuel have to always be zero, as that's what it is right now.

Then, the fuel gets ejected from the rocket. Let's assume that all of it is ejected, so that we have separated the fuel and the rocket completely (but they stay as one system since no external forces are acting). Now, the fuel's velocity v_f is negative.

If the momentum of the rocket $m_r v_r$ (*not* the momentum of the whole system) were to stay constant, then we would get a negative total momentum of the system. That can't be right!

Try to think of what has to happen now (Hint: this is the final step to my explanation of the question that we asked before).

We need to counter this negative momentum of the fuel. To do this, we have to make the momentum of the rocket be equal and opposite (positive in this case) to the momentum of the fuel. Then, they will cancel out and the total momentum will be 0, just as before. Since the mass of the rocket cannot change (remember that m_r is the mass of the rocket *not including* the fuel), its velocity has to change in the positive direction. That is how the rocket moves!

The rocket equation describes the motion of a rocket using this mechanism of one. However, most of the mass of the system is just the fuel. While in a car, say, the fuel is only around 4% of the mass, in rockets it is 85%! We build our rockets around the Tsiolkovsky formula. This effect of it is known as the "Tyranny of the Rocket Equation"; instead of reading, you can also watch this video. Both are by flight engineer Don Pettit.

FICTION

This is a free land without boundaries.
Become a pioneer. Come and build your world!
That's what defines fiction within Astra News.

Pages 12 - 18

In this issue

Collage by Leonid Vishnevskiy

Usually, I make short introductions to content in the magazine. But here it is different. What you will read on these next few pages do not need an introduction; however, we'll be longing to know

the end.

CREATIVE WRITING

The creative writing intensive students of Astra Nova School have been working on their short stories and starting novels for the past school year. In months to come they will be publishing their stories. Here are some sneak peaks of the students work:

Sumi Katakam. Emergence of the Doppelgängers

Adrian jogged up to the boarding area of the spaceship, except jogging was probably an unsuitable description of his movement. It was more of an uncoordinated trot, a desperate attempt to arrive at the right spot amid the disarray unfurling in his mind. In a flurry of franticness, he switched his view to his internal watch.

Only then did Adrian fully realize the true fluidity of time. It was not a constant measure, instead, it was something that fluctuated, usually to your disadvantage. As he switched his view, he felt the fluid thickening, it slowly crawling over the surface of his perception. He could almost see the individual frames in the rendering of the switching. He was no longer seeing the boarding area in front of him, instead, an intermediary view of darkness, then, a digital clock, each pixel rendering in his vision one by one. As he did this, his legs slowed to a stop, in order to prevent an awkward collision with a passerby. Turns out, he had a single minute before boarding would close. He once again switched his view, this time to the airport. Then he ran. He ran like he's never run before.

Elizabeth Yerushalmi. The Hood Rats

When you think of Beverly Hills, you think of rich families, mansions, cool cars, fancy restaurants, money. But what most people don't know is that there's another side of Beverly Hills, the poor side. It's filled with crummy apartments, single moms, and parents trying to send their kids to a good school, with the rich kids. It's East of Beverly Drive. They call it the hood, and we were the hood rats.

Mira. The Missing

Lissa was just a normal girl with a normal life. But her life changed quickly as she visited a small town for vacation. What seemed like an innocent happy town, turned out to be a place with lots of darkness and secrets inside of it. Rumors started spreading about how multiple kids vanished from the houses years before. Lissa started getting strange notes telling her to leave. Will Lissa survive her 2 weeks, or will she be the next victim?

Winston Lin. Control

I open my eyes.

I see a long, white, hallway. It's dimly lit, and I can't see the end of it.

Someone walks out of one of the many metal doors lining the hallway and turns away.

I didn't see the face, but I could tell that it was a woman.

A shiver of recognition runs through me, but I can't quite place why.

I contemplate whether to follow her. Instinct takes over, and I find myself walking slowly and quietly behind her.

She stops.

I stop.

She places her fingerprint to access what seems like a laboratory and slips in quietly, closing the door behind her.

I look at the door for what seems like an eternity.

I give the keypad a tentative touch with my finger.

"Access Granted."

A quiet, robotic voice announced my presence. It almost seemed too loud, with the silence that followed.

James Pan. Exposition

The enemy man-at-arms stood directly in front of the Gate, boasting and shouting, mocking his many enemies and encouraging them to fight himself whilst pacing gradually before them. He received no direct response. Instead, the soldiers murmured amongst themselves, too intimidated by his stature and disposition to confront him. Beow, in contrast to the others, remained distinctly silent and refused to display any strong emotions. The men on the distinct sides of the courtyard subsequently prepared, standing and grasping their variety of weapons in a manner characteristic of the period before confrontation. Beow leaned forward slightly, staring directly in front of him. He grasped his Two-Handed Sword with his primary hand, resting the upward portion of the shaft upon his respective shoulder with the acute point positioned upwards and the edges perpendicular to his shoulder. He adjusted his helmet and put down the visor, restricting his sight but providing his face with further improved protection. They were nervous, conscious of the consequences that may result from direct confrontation. The frequency of Beow's breaths gradually decreased, and his palms started to perspire. He could hear the breaths reverberating throughout the helmet. He removed the sword from its position upon his back, and then started to walk carefully in the direction of the enemy.

Victoria Hiatt. From the Other Side

“Come.”

The dining room already seemed so loud, everyone speaking their mind on what they thought was best. So loud even without the thoughts that seemed to be infiltrating my mind. I almost chuckled at how insane it seemed, the thought of someone else’s works of their mind, parading into my thoughts.

Then it happened again, “*Come,”* it said.

I could barely focus on the prospect of eating, my hands shaking from the constant thumping that came from my chest. Each time the words trickled through my mind, more thumping sounded from my heart. Each beat took hold, finding its way out to the palms of my hands already glistening in sweat.

Anonymous. I want my life back

I was a nobody. A thief. A failure. But sometimes you have to live in the moment. For me, that was now. I felt the humid air beating down the back of my neck. My breathing gradually increased into deep breaths. Inhale. Exhale. I was nervous, I always was. He charged at me and the battle began, I guess. He struck first, dodging, as I always did, I landed a punch. He ate that thing. He just walked forward. I jumped into him, grabbing him in a clinch, I slammed my shoulder into his face. He recovered almost instantly. He dove at me, trying to tackle me. But I had the reflexes, living on the streets, being places I shouldn’t, it all paid off.

Anonymous. Shadow Genesis/ Sara with the Shadows

"Sit down, child. I'm going to tell you a story.” With a sigh that was probably a lot louder than it needed to be, Sophy dropped down onto the suede couch and crossed her arms tightly over her chest. In less than five minutes, her perfect day had gone right out the window. Whenever her parents dragged her over to her great - great - aunt Kara's house because they had to work late, Sophy was forced to sit in the same position for hours on end, her mind slowly dissolving into slush as her ailing relative droned on. Sophy dreaded her aunt's stories. They usually took all day to tell, and in the end, nothing had been told at all.

Anonymous. Mirroring

Lightning struck the sky as the sound of thunder clapped through the trees. A girl stood on the balcony. Her hair whipped sideways with the wind as she looked up towards the sky, which was bruised with the marks of uneasiness within the clouds. She leaned onto the railing as if it were some comfort to the storm. The rain poured down on her as if she was planted at the foot of a waterfall, but she remained still. In a sense, the rain made her feel like she belonged. Even though it wetted her hair and face, she still felt like she belonged in the storm. The girl closed her eyes as she inhaled the salty stench. The rain was so loud but comforting, the perfect distraction from the chaotic life surrounding her. She was distracted. Too distracted to hear the doors fling open behind her. Far too distracted to hear the large boots walk up behind her. The girl began to snap back to reality moments before hands pushed her. She let out a scream as her body jolted forwards and tipped over the railing. It was too late.

Anonymous. The Swap

I don't really understand how I ended up here. I can't believe how much I've changed, for the better and worse. But I want to be able to understand and reflect on these changes in the future, so here's day one of this crazy chapter in my life. We start with the moment this day became important.

"Ok, so the pairings are… Juan and Ari, Eleanor and Maya, Otis and Maeve…" our English teacher, Ms. Butterfield, went on assigning partners, but my mind had stopped.

ARGHHHH. Sorry, I needed to get it out. But seriously, I couldn't believe *SHE* had to be my partner. She backstabbed me ruthlessly, even daring to make it a slow burn, and she dared to say that "it's not my fault". This felt like the end of my world. Despite that, I realized I just had to focus on the project, no relationship beyond business. I looked up at the board, realizing I'd, out of panic, suddenly looked down at my notebook when the teacher had thrown this crazy brick in my face. (Metaphorically, of course)

Adventures of a Magic Boy

First Adventure

collage and accompanying story by Leonid Vishnevskiy

Morning, first day of summer. The boy woke up before everyone else. A feeling of happiness engulfed him, and he tried to remember from what. The day before, his mom and dad told him that the whole family would travel to the beach tomorrow. That's it! He is not quite sure what the beach is, but his mom showed him wonderful pictures of it and told how joyful it is there. Here he is now, waiting impatiently for the adults to wake up. Meanwhile, he decided to get up and look through the window.

Where the front yard ends is … the beach? It's so beautiful! He realizes that the pictures of the beach were, in reality, dull. And so many people there, each of them busy with something of their own. However, one little boy in a great black hat stopped digging and is watching our boy attentively.

Our boy becomes confused and doesn't know how to respond yet. He notices that while it is sunny on the beach, the sky is dark; and something gigantic and round dominates the sky. Surely watching it down on the beach below is a strange lady with an open umbrella.

Before he is able to perceive that the feeling of happiness engulfs him even stronger than before, he is already running out onto the beach; and the boy in the hat smiles at him and waves his hand.

He doesn't remember how he appeared on the beach, because the sun stretches its ray onto his bed, and wakes him up. He gets up and runs to look outside. Everyone and everything are gone: the boy, the lady, the people, the beach…

Everything but the feeling, and the boy immediately knows that it will never leave him.

IMPRESSIONS

"Good Bye, Lenin!" (2003)
movie review
by Leonid Vishnevskiy

pages 19 - 20

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. From here comes the name "Impressions". I purposely omitted the word "text", because why limit ourselves to text? And why limit ourselves to movies and books?

In this issue

I fully understood one of the last scenes of the movie when I was designing this page and combined these two film frames together.

"Good Bye, Lenin!" is rated "R", so you would have to have your parents' permission to watch it. But because I know that such a rating doesn't reflect any violence in this particular movie, I would still review it. The purpose of my review would be to get you interested in this movie to watch it when you are older. I believe that it's one of the best movies that could be dedicated to Mother's Day on May 8 this year in a world that is tragically reshaping itself once again.

It is a kind of a movie that you unlikely will interpret differently when you watch it for the first time younger as you would again older. Instead, you will be gaining a more complex and deeper understanding. I first watched this movie two years ago and then rewatched it in the summer of 2021, my review mainly dates back then.

You would need to know some history to better understand the movie. In case you don't know much about the Berlin Wall, the symbol of the Cold War, here is a brief overview of this matter.

Good Bye, Lenin!

Movie review by Leonid Vishnevskiy

There was once an East Germany. And then there were two.

A boy, Alex, was protesting in East Germany and he along with others was taken by the police. Upon seeing this, his mother has a heart attack and is fell into a coma. The year is 1989. Once she wakes up, eight months later, the Berlin Wall, separating East Germany from West Germany, was already torn down, and the two countries had practically become one. She is at risk of having a second heart attack which would kill her, and for that reason she is not allowed to get excited. Because she was "married to the socialist German motherland", she cannot know of the Berlin Wall's tearing, so Alex creates an imaginary East Germany for his mom.

In the opening scene the movie pays attention to the first German flight into space, done by Sigmund Jahn. Jahn is portrayed as the boy's idol. However, for most of the movie he is with his mother, hiding her from what is happening in Germany, and Jahn appears only one more time closer to the end. He is then a taxi driver, at first refusing to acknowledge who he is. Or perhaps he is a taxi driver?

Eventually Alex's mom gets suspicions of what is going on, and to avoid her finding out Alex convinces Jahn to be in a video, announcing Jahn's new role in the East German government after the resignation of a major person in it (Erich Honecker), and of West German refugees fleeing into the East after the Wall was torn down.

One might get a notion that Alex's mom was told about the wall's tearing by Lara, Alex's girlfriend, and knew about it since then. But watch it more closely and you will realize that even if she was told so by Lara, she didn't believe it until the video with Sigmund Jahn, shown after. Germany is run by her son's childhood icon, the first German cosmonaut… Now she believed in what Lara told her, but in her heart, she now also believes much more than what East Germany once was for her. Of course, what we just learned Alex never would. All his mother would say is an exclamation "Fantastic!"

There are many dialogues and scenes in the movie that could be taken as what defines the film. Each of us will have our own interpretations. For me this film is defined by three scenes, each of which comes from the next. In the first one Alex was watching the sky by himself and says that reality is just as much a mirage as his mother's envisioning of it (at that time he was already creating an imaginary reality for his mom). In the second scene Alex asks Sigmund Jahn to make a speech that proclaims reaching the ideal state of relations between people (those who we thought were our enemies turned out to be our best friends). In the third scene, which is the finale, Alex speaks of an imaginary country that for him will always be with his mom. And at that moment you may realize that the fall of the Berlin Wall, East and West Germany, all of it was a decoration. And the title of the movie itself is deceiving.

"Good Bye Lenin!" trailer (no R-rated material here)

SCIENTISTS WATCH MOVIES

Pages 22 - 25

ABOUT SCIENTISTS WATCH MOVIES

Create a science problem(s) based on your favorite movie or on a cult movie. In one magazine issue define the problem, and in the next issue publish the solution. It can be any science-related problem, not only physics. The first such problem can be found in the 5th issue of Astra News, under the name “When Light Leaves Us in the Darkness” and then in the 8th and 10th issues.

You can also write an article discussing movie bloopers that aren’t correct from the science perspective.

In this issue

In this issue is an answer to the problem that was published in the 10th issue of *Astra News* and dedicated to the movie "2001: A Space Odyssey."

On the picture

Chimpanzee Ham.
On January 31, 1961 Ham became the first chimpanzee in space.

Answer to the physics problem published in the 10th issue

By Leonid Vishnevskiy

An Ape and a Bone

An ape threw a bone into the air and it reached its peak height in 5.15 seconds.

- What is that peak height?
- What is the velocity at which the ape threw the bone?

Solution:

We can first use the equation for final velocity.

$$V = V_{iy} - gt \tag{1}$$

$$0 = V_{iy} - gt$$

$$V_{iy} = gt$$

$$V_{iy} = 9.8 * 5.15 = 50.5\ m/s$$

Then, we can use the equation for conservation of energy to solve for height.

$$mgh = \frac{1}{2}mV_{iy}{}^2 \tag{2}$$

$$gh = \frac{1}{2}V_{iy}{}^2$$

$$h = \frac{V_{iy}{}^2}{2g} = \frac{50.5^2}{2 * 9.8} = 130.1\ m$$

Alternate, more difficult solution:

First, let's write down the equation for conservation of energy.

$$mgh = \frac{1}{2}mV_{iy}{}^2$$

Then, we can rearrange the equation for the initial y-velocity.

$$gh = \frac{1}{2}V_{iy}{}^2$$

$$V_{iy} = \sqrt{2gh}$$

Now, we can insert the initial y-velocity into the equation for height.

$$h = V_{iy}t - \frac{1}{2}gt^2 \tag{3}$$

$$h = \sqrt{2gh} * t - \frac{1}{2} * g * t^2$$

$$\left(h + \frac{1}{2} * g * t^2\right)^2 = \left(\sqrt{2gh} * t\right)^2$$

$$\left(h + \frac{1}{2} * 9.8 * 5.15^2\right)^2 = \left(\sqrt{2gh} * t\right)^2$$

$$(h + 130)^2 = \left(\sqrt{2gh} * t\right)^2$$

$$h^2 + 260h + 16900 = \left(\sqrt{2 * 9.8 * h} * 5.15\right)^2$$

$$h^2 + 260h + 16900 = 520h$$

$$h^2 + 260h - 520h + 16900 = 0$$

$$h^2 - 260h + 16900 = 0$$

$$h_{1,2} = \frac{-(-260) \pm \sqrt{(-260)^2 - 4 * 1 * 16900}}{2 * 1}$$

$$h = \frac{260 \pm 0}{2} = 130\ m$$

Since we've found the height, we can plug that value back into the algebraically manipulated form of Equation (2).

$$V_{iy} = \sqrt{2gh} = \sqrt{2 * 9.8 * 130} = \sqrt{2548} = 50.5 m/s$$

We solved the problem in two different ways and got to the same answer. The minor difference between 130.1 meters and 130 meters is due to different rounding in each step of the solutions.

On the right is a movie frame from "2001: A Space Odyssey"


MEMORY
TERMINAL
2
3
4
5
6
1
2
LT/3
LT/3
LT/3
LT/3
LT/3
MT
MT
10
11
12
7

The Vitruvian Man

By Leonid Vishnevskiy

In front of you is a painting by the Belgian artist Pieter Bruegel the Elder.

The sun is on the horizon, a ship sails out into the sea. A shepherd gazes into the sky, a farmer plows with a horse. A great city on the seashore sits in the background. Quite a peaceful scene.

How soon do you notice the man in the sea?

This painting is called “Landscape with the Fall of Icarus”.

I decided to start the series “The Vitruvian Man” with this painting.

While his reason for flight was not about space exploration as we would define it now, I think that it gives us a hint that sometime in the future our descendants might enter a new stage of space exploration of which we might not be aware of yet.

Besides that, it’s one of the most beautiful and puzzling paintings that I know of and I wanted to share it with you. This painting is also featured in Andrei Tarkovsky’s *Solaris* (1972). Please, watch it and among other things discover the sails in this movie scene.

In the next, 12th issue of Astra News this series will continue with stories about people who took their part in exploring space.