

Ode to Happiness for Sunday February 28 2021

## Cygnus Mosaic 2010 - 2020



*[Image Credit & Copyright: J-P Metsavainio (Astro Anarchy)]*

In brush strokes of interstellar dust and glowing gas, this beautiful skyscape is painted across the plane of our Milky Way Galaxy near the northern end of the Great Rift and the constellation Cygnus the Swan.

Composed over a decade with 400 hours of image data, the broad mosaic spans an impressive 28x18 degrees across the sky. Alpha star of Cygnus, bright, hot, supergiant Deneb lies at the left.

Crowded with stars and luminous gas clouds Cygnus is also home to the dark, obscuring Northern Coal Sack Nebula and the star forming emission regions NGC 7000, the North America Nebula and IC 5070, the Pelican Nebula, just left and a little below Deneb.

Many other nebulae and star clusters are identifiable throughout the cosmic scene. Of course, Deneb itself is also known to northern hemisphere skygazers for its place in two asterisms, marking a vertex of the Summer Triangle, the top of the Northern Cross.

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## Dancing Through the Decades



<https://www.facebook.com/watch/?v=1244242022595066>

George Smith explains, "I watch this every morning to get me out of the virus doldrums." I see it as proof there were other dancers besides Fred Astaire....but...

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## **What is the Cosmological Constant?**

By Adam Mann - Live Science Contributor



*Artist depiction of a supernova explosion in space. In the 1990s, researchers used supernovae to identify dark energy's existence, bringing science back to Einstein's once-discarded cosmological constant.  
(Image credit: Shutterstock)*

The cosmological constant is presumably an enigmatic form of matter or energy that acts in opposition to gravity and is considered by many physicists to be equivalent to dark energy. Nobody really knows what the cosmological constant is exactly, but it is required in cosmological equations in order to reconcile theory with our observations of the universe.

Albert Einstein, the famous German-American physicist, came up with the cosmological constant, which he called the "universal constant," in 1915 as a means to balance certain calculations in his theory of general relativity. At the time, physicists believed the universe was static — neither expanding nor contracting — but Einstein's work suggested that gravity would cause it to do one or the other. So, to mesh with the scientific consensus, Einstein inserted a fudge factor, denoted by the Greek letter lambda, into his results, which kept the cosmos still.

Yet a little over a decade later, the American astronomer Edwin Hubble noticed that galaxies were actually moving away from us, indicating the universe was expanding. Einstein called lambda his "greatest mistake."

Hubble's observations negated the need for a cosmological constant for decades, but that changed when astronomers examining distant supernovas in the late 1990s discovered that the cosmos was not only expanding, but accelerating in its expansion. They named the mysterious anti-gravity force required to account for this phenomena "dark energy."

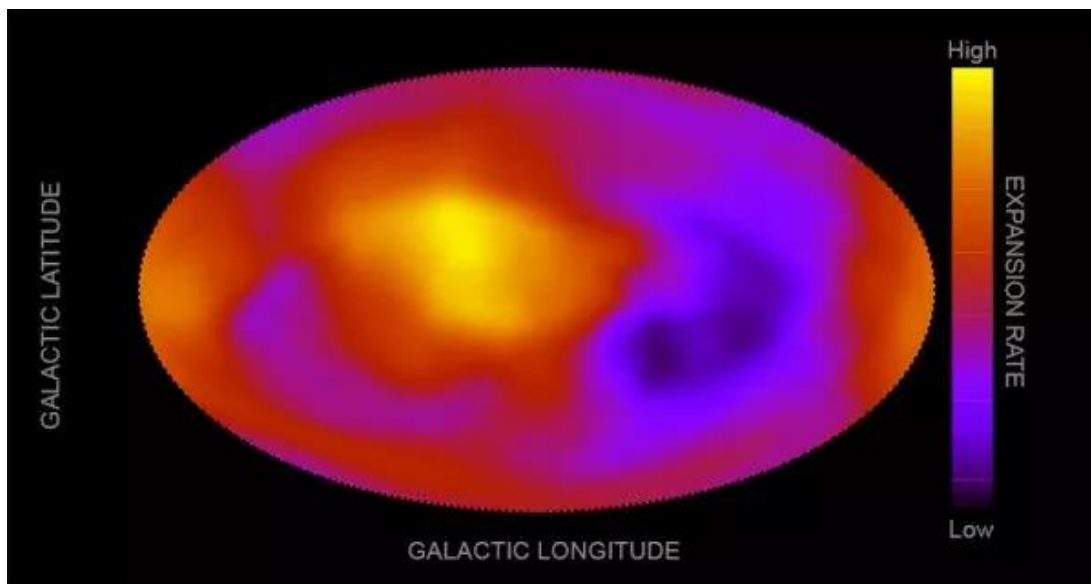
In the 1920s, Russian physicist Alexander Friedmann developed an equation, now called the Friedmann Equation, which describes the properties of the universe from the Big Bang onward, according to an online tutorial from Georgia State University.

By dusting off Einstein's lambda and plugging it into the Friedmann equations, researchers could model the cosmos correctly — that is, with an accelerating expansion rate. This version of the Friedmann Equation now forms the backbone of contemporary cosmological theory, which is known as  $\Lambda$ CDM (Lambda CDM, where CDM stands for cold dark matter) and accounts for all the known components of reality.

However, no one truly understands what lambda is. Most physicists consider it interchangeable with the concept of dark energy, but that doesn't make things any clearer because dark energy is simply a placeholder describing some unknown anti-gravity substance. So, we've essentially reverted to using Einstein's fudge factor.

One potential explanation for the cosmological constant lies in the realm of modern particle physics. Experiments have verified that empty space is permeated by countless virtual particles constantly popping in and out of existence. This ceaseless action creates what is known as a "vacuum energy," or a force arising from empty space, inherent in the fabric of space-time that could drive apart the universe.

This graphic shows a map of the universe's expansion rates in different directions, estimated in a new study by Konstantinos Migkas and collaborators. The map is in galactic coordinates, with the center looking toward the center of our galaxy. The black and purple colors show the directions of the lowest expansion rates (the Hubble constant); yellow and red show the directions of the highest expansion rates.



*This graphic shows a map of the universe's expansion rates in different directions. The map is in galactic coordinates, with the center looking toward the center of our galaxy. The black and purple colors show the directions of the lowest expansion rates (the Hubble constant); yellow and red show the directions of the highest expansion rates.*

*(Image credit: University of Bonn/K. Migkas et al.)*



But connecting vacuum energy to the cosmological constant is not straightforward. Based on their observations of supernovas, astronomers estimate that dark energy should have a small and sedate value, just enough to push everything in the universe apart over billions of years.

Yet when scientists try to calculate the amount of energy that should arise from virtual particle motion, they come up with a result that's 120 orders of magnitude greater than what the supernova data suggest.

Related: The worst theoretical prediction in the history of physics

To add to the conundrum, some researchers have proposed that the cosmological constant might not be a constant at all, but rather changes or fluctuates with time. This theory is called quintessence and some projects, such as the Dark Energy Survey, are currently making precise observations to see if it has any observational support.

In the meantime, cosmologists will continue to use lambda. They may not know what it is, but they know that they need it to make the universe make sense.

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## **Alexandra Trusova; 1st place Ladies Free Skate at Skate Canada 2019**



*Alexandra Trusova at Skate Canada in 2019*  
*printrest.com*

<https://www.youtube.com/watch?v=ejyxJfwdYrU>

Seventeen year old Alexandra "Sasha" Vyacheslavovna Trusova currently holds the world record for the free skate. She is the 2020 European bronze medalist, the 2019 Grand Prix Final bronze medalist, the 2019 Skate Canada champion, the 2019 Rostelecom Cup champion, the 2019 CS Ondrej Nepela Memorial champion, and a three-time Russian national medalist

The way things are going these days it won't be long before skaters will be capable of achieving Low Earth Orbit without booster rockets.

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### **Great Bedfellows**



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"There comes a time in your life, when you walk away from all the drama  
and people who create it.

You surround yourself with people who make you laugh.  
Forget the bad, and focus on the good.

Love the people who treat you right, pray for the ones who don't.  
Life is too short to be anything but happy.  
Falling down is a part of life, getting back up is living."

*Kay Martin sent these. Their message is the one I hope the Odes present.*

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**Harpist Sophia Kiprskaya Displays Her Virtuosity**



[https://www.youtube.com/watch?v= xn3uAHZHcc](https://www.youtube.com/watch?v=xn3uAHZHcc)

The featured piece is Johann Sebastian Bach's Tocatta and Fugue in D minor, and if you keep listening you'll hear her play Bedrich Smetana's Moldau, Eduard Kiprsky's elegiac Concertino for Harp and String Quartet, and Claude Debussy's Sonata for Flute, Harp and Viola.

Sofia Kiprskaya was born in 1991 and began to study music at the age of five. She received a postgraduate degree at the St. Petersburg State Rimsky-Korsakov Conservatoire (class of Anna Makarova) and continually engages in master classes with renowned harpist Jana Boušková at the Prague Conservatoire. At 30, she has a brilliant career before her.

Herbert Von Karajan is reputed to have said of the Grand Piano, "What a pity they enclose a beautiful harp in such an ugly box." Well I won't go that far, but aside from being a gorgeous instrument, the harp in the proper hands has some special qualities

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## **NASA's Mars Helicopter Reports In**





*In this illustration, NASA's Ingenuity Mars Helicopter stands on the Red Planet's surface as NASA's Perseverance rover (partially visible on the left) rolls away.*

*Credit: NASA/JPL-Caltech*

The technology demonstration has phoned home from where it is attached to the belly of NASA's Perseverance rover.

Mission controllers at NASA's Jet Propulsion Laboratory in Southern California have received the first status report from the Ingenuity Mars Helicopter, which landed Feb. 18, 2021, at Jezero Crater attached to the belly of the agency's Mars 2020 Perseverance rover. The downlink, which arrived at 3:30 p.m. PST (6:30 p.m. EST) via a connection through the Mars Reconnaissance Orbiter, indicates that both the helicopter, which will remain attached to the rover for 30 to 60 days, and its base station (an electrical box on the rover that stores and routes communications between the rotorcraft and Earth) are operating as expected.

"There are two big-ticket items we are looking for in the data: the state of charge of Ingenuity's batteries as well as confirmation the base station is operating as designed, commanding heaters to turn off and on to keep the helicopter's electronics within an expected range," said Tim Canham, Ingenuity Mars Helicopter operations lead at JPL. "Both appear to be working great. With this positive report, we will move forward with tomorrow's charge of the helicopter's batteries."

Ensuring that Ingenuity has plenty of stored energy aboard to maintain heating and other vital functions while also maintaining optimal battery health is essential to the success of the Mars Helicopter. The one-hour power-up will boost the rotorcraft's batteries to about 30% of its total capacity. A few days after that, they'll be charged again to reach 35%, with future charging sessions planned weekly while the helicopter is attached to the rover. The data downlinked during tomorrow's charge sessions will be compared to battery-charging sessions done during cruise to Mars to help the team plan future charging sessions.

Like much of the 4-pound (2-kilogram) rotorcraft, the six lithium-ion batteries are off-the-shelf. They currently receive recharges from the rover's power supply. Once Ingenuity is deployed to Mars' surface, the helicopter's batteries will be charged solely by its own solar panel.

After Perseverance deploys Ingenuity to the surface, the helicopter will then have a 30-Martian-day (31-Earth-day) experimental flight test window. If Ingenuity survives its first bone-chilling Martian nights – where temperatures dip as low as minus 130 degrees Fahrenheit (minus 90 degrees Celsius) – the team will proceed with the first flight of an aircraft on another world.

If Ingenuity succeeds in taking off and hovering during its first flight, over 90% of the project's goals will have been achieved. If the rotorcraft lands successfully and remains operable, up to four more flights could be attempted, each one building on the success of the last.

"We are in uncharted territory, but this team is used to that," said MiMi Aung, project manager for the Ingenuity Mars Helicopter at JPL. "Just about every milestone from here through the end of our flight demonstration program will be a first, and each has to succeed for us to go on to the next. We'll enjoy this good news for the moment, but then we have to get back to work."

Next-generation rotorcraft, the descendants of Ingenuity, could add an aerial dimension to future exploration of the Red Planet. These advanced robotic flying vehicles would offer a unique viewpoint not provided by current orbiters high overhead or by rovers and landers on the ground, providing high-definition images and reconnaissance for robots or humans, and enable access to terrain that is difficult for rovers to reach.

#### More About Ingenuity

The Ingenuity Mars Helicopter was built by NASA's Jet Propulsion Laboratory in Southern California which also manages the technology demonstration for NASA Headquarters in Washington. NASA's Ames and Langley Research Centers provided significant flight performance analysis and technical assistance. AeroVironment Inc., Qualcomm, Snapdragon, and SolAero also provided design assistance and major vehicle components. The Mars Helicopter Delivery System was designed and manufactured by Lockheed Space Systems in Denver.

For more information about Ingenuity:

<https://go.nasa.gov/ingenuity-press-kit>

<https://mars.nasa.gov/technology/helicopter>

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## **Colonoscopy Journal**

By Dave Barry, a Pulitzer Prize-winning humor columnist for the Miami Herald



I called my friend Andy Sable, a gastroenterologist, to make an appointment for a colonoscopy.

A few days later, in his office, Andy showed me a color diagram of the colon, a lengthy organ that appears to go all over the place, at one point passing briefly through Minneapolis.

Then Andy explained the colonoscopy procedure to me in a thorough, reassuring and patient manner.

I nodded thoughtfully, but I didn't really hear anything he said, because my brain was shrieking, *'he's going to stick a tube 17,000 feet up your behind!'*



*The 17,000 feet of tubing arrives ready for the festivities.*

I left Andy's office with some written instructions, and a prescription for a product called 'MoviPrep,' which comes in a box large enough to hold a microwave oven. I will discuss MoviPrep in detail later; for now suffice it to say that we must never allow it to fall into the hands of America 's enemies.

I spent the next several days productively sitting around being nervous.

Then, on the day before my colonoscopy, I began my preparation. In accordance with my instructions, I didn't eat any solid food that day; all I had was chicken broth, which is basically water, only with less flavor.

Then, in the evening, I took the MoviPrep. You mix two packets of powder together in a one-litre plastic jug, then you fill it with lukewarm water. (For those unfamiliar with the metric system, a litre is about 32 gallons). Then you have to drink the whole jug. This takes about an hour, because MoviPrep tastes - and here I am being kind - like a mixture of goat spit and urinal cleanser, with just a hint of lemon.

The instructions for MoviPrep, clearly written by somebody with a great sense of humor, state that after you drink it, 'a loose, watery bowel movement may result.'

This is kind of like saying that after you jump off your roof, you may experience contact with the ground.

MoviPrep is a nuclear laxative. I don't want to be too graphic, here, but, have you ever seen a space-shuttle launch? This is pretty much the MoviPrep experience, with you as the shuttle. There are times when you wish the commode had a seat belt. You spend several hours pretty much confined to the bathroom, spurting violently. You eliminate everything. And then, when you figure you must be totally empty, you have to drink another litre of MoviPrep, at which point, as far as I can tell, your bowels travel into the future and start eliminating food that you have not even eaten yet.

After an action-packed evening, I finally got to sleep.

The next morning my wife drove me to the clinic. I was very nervous. Not only was I worried about the procedure, but I had been experiencing occasional return bouts of MoviPrep spurtage. I was thinking, 'What if I spurt on Andy?' How do you apologize to a friend for something like that? Flowers would not be enough.

At the clinic I had to sign many forms acknowledging that I understood and totally agreed with whatever the heck the forms said. Then they led me to a room full of other colonoscopy people, where I went inside a little curtained space and took off my clothes and put on one of those hospital garments designed by sadist perverts, the kind that, when you put it on, makes you feel even more naked than when you are actually naked.

Then a nurse named Eddie put a little needle in a vein in my left hand. Ordinarily I would have fainted, but Eddie was very good, and I was already lying down Eddie also told me that some people put vodka in their MoviPrep.



At first I was ticked off that I hadn't thought of this, but then I pondered what would happen if you got yourself too tipsy to make it to the bathroom, so you were staggering around in full Fire Hose Mode. You would have no choice but to burn your house.

When everything was ready, Eddie wheeled me into the procedure room, where Andy was waiting with a nurse and an anesthesiologist. I did not see the 17,000-foot tube, but I knew Andy had it hidden around there somewhere. I was seriously nervous at this point.

Andy had me roll over on my left side, and the anesthesiologist began hooking something up to the needle in my hand.

There was music playing in the room, and I realized that the song was 'Dancing Queen' by ABBA. I remarked to Andy that, of all the songs that could be playing during this particular procedure, 'Dancing Queen' had to be the least appropriate.

'You want me to turn it up?' said Andy, from somewhere behind me...

'Ha ha,' I said. And then it was time, the moment I had been dreading for more than a decade. If you are squeamish, prepare yourself, because I am going to tell you, in explicit detail, exactly what it was like.

I have no idea. Really. I slept through it. One moment, ABBA was yelling 'Dancing Queen, feel the beat of the tambourine,' and the next moment, I was back in the other room, waking up in a very mellow mood.

Andy was looking down at me and asking me how I felt. I felt excellent. I felt even more excellent when Andy told me that it was all over, and that my colon had passed with flying colors. I have never been prouder of an internal organ.

On the subject of Colonoscopies...

Colonoscopies are no joke, but these comments during the exam were quite humorous. A physician claimed that the following are actual comments made by his patients (predominately male) while he was performing their colonoscopies:

1. Take it easy Doc. You're boldly going where no man has gone before.
2. 'Find Amelia Earhart yet?'
3. 'Can you hear me NOW?'
4. 'Are we there yet? Are we there yet? Are we there yet?'
- 5 'You know, in Arkansas, we're now legally married.'
6. 'Any sign of the trapped miners, Chief?'
7. 'You put your left hand in, you take your left hand out...'
8. 'Hey! Now I know how a Muppet feels!'
9. 'If your hand doesn't fit, you must quit!'
10. 'Hey Doc, let me know if you find my dignity.'

11. 'You used to be an executive at Enron, didn't you?'

12. 'God, now I know why I am not gay'

And the best one of all:

13. 'Could you write a note for my wife saying that my head is not up there?'

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## Know Your Associates

A great lesson in leadership...SF, Lancer (aka Mike Sullivan)



Arcelor-Mittal Steel, feeling it was time for a shakeup, hired a new CEO. The new boss was determined to rid the company of all slackers.

On a tour of the facilities, the CEO noticed a guy leaning against a wall. The room was full of workers and he wanted to let them know that he meant business. He asked the guy, "How much money do you make a week?"

A little surprised, the young man looked at him and said, "I make \$1000 a week. Why?"

The CEO said, "Wait right here." He walked back to his office, came back in two minutes, and handed the guy \$4000 in cash and said, "Here's four weeks' pay. Now get out and don't come back."

Feeling pretty good about himself the CEO looked around the room and asked, "Does anyone want to tell me what that goof-ball did here?" From across the room a voice said, "Pizza delivery guy from Domino's."

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## One Good Deed Deserves...

There was a man who worked for the Post Office whose job was to process all the mail that had illegible addresses.



One day, a letter came addressed in a shaky handwriting to God with no actual address. He thought he should open it to see what it was about. The letter read:

Dear God,

I am an 83 year old widow, living on a very small pension.

Yesterday someone stole my purse. It had \$100 in it, which was all the money I had until my next pension payment.

Next Sunday is Christmas, and I had invited two of my friends over for dinner. Without that money, I have nothing to buy food with, have no family to turn to, and you are my only hope... Can you please help me?

Sincerely, Edna

The postal worker was touched. He showed the letter to all the other workers. Each one dug into his or her wallet and came up with a few dollars.

By the time he made the rounds, he had collected \$96, which they put into an envelope and sent to the woman.

The rest of the day, all the workers felt a warm glow thinking of Edna and the dinner she would be able to share with her friends.

Christmas came and went.

A few days later, another letter came from the same old lady to God. All the workers gathered around while the letter was opened.



It read:

Dear God,

How can I ever thank you enough for what you did for me?

Because of your gift of love, I was able to fix a glorious dinner for my friends. We had a very nice day and I told my friends of your wonderful gift.

By the way, there was \$4 missing.

I think it might have been those thieves at the post office.

Sincerely, Edna

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### **Lewis Carroll; The Jabberwocky**





<https://jabberwockystew.net/jabberwocky-index/>

Lewis Carroll—the pen name of Charles Lutwidge Dodgson—wrote *Through the Looking Glass*—published in 1871—a follow-up nonsense novel to *Alice’s Adventures in Wonderland*. Everything beyond the looking glass—including logic—is reversed and Alice has many strange things happen to her. There are several songs and poems sprinkled throughout the story, but the most famous is the poem *Jabberwocky*, about a horrible beast that the hero slays. Alice finds this poem in a book that she cannot read, until she holds the book up to a mirror to turn the letters the right way around.

### **Original Jabberwocky**

‘Twas brillig, and the slithy toves  
Did gyre and gimble in the wabe:  
All mimsy were the borogoves,  
And the mome raths outgrabe.

“Beware the Jabberwock, my son!  
The jaws that bite, the claws that catch!  
Beware the Jubjub bird, and shun  
The frumious Bandersnatch!”

He took his vorpal sword in hand:  
Long time the manxome foe he sought—  
So rested he by the Tumtum tree,  
And stood a while in thought.

And, as in uffish thought he stood,  
The Jabberwock, with eyes of flame,  
Came whiffing through the tulgey wood,  
And burbled as it came!

One, two! One, two! And through and through  
The vorpal blade went snicker-snack!  
He left it dead, and with its head  
He went galumphing back.

“And, hast thou slain the Jabberwock?  
Come to my arms, my beamish boy!  
Oh frabjous day! Callooh! Callay!”  
He chortled in his joy.

'Twas brillig, and the slithy toves  
Did gyre and gimble in the wabe:  
All mimsy were the borogoves,  
And the mome raths outgrabe.

Note: Lewis Carroll made up many of the words in this poem, but he had an opinion on how those words should be pronounced. He later provided a pronunciation guide to aid his readers.

Shortly after it was published, the Jabberwocky was translated into Latin by Hassard H. Dodgson—Charles Lutwidge Dodgson's uncle (tr. circa 1871).

## **Gaberbocchus**

Hassard H. Dodgson



*Verdouxwordpress.com*

Hora aderat briligi. Nunc et Slythia Tova  
Plurima gyrabant gymbolitare vabo;  
Et Borogovororum mimzebant undique formae,  
Momiferique omnes exgrabure Rathi.

“Cave, Gaberbocchum moneo tibi, nate cavendum  
(Unguibus ille rapit. Dentibus ille necat.)  
Et fuge Jubbubum, quo non infestior ales,  
Et Bandersnatcham, quae fremit usque, cave.”

Ille autem gladium vorpalem cepit, et hostem  
Manxonium long sedulitate petit;

Tum sub tumtummi requiescens arboris umbr  
Stabat tranquillus, multa animo meditans.

Dum requiescebat meditans uffishia, monstrum  
Praesens ecce! Oculis cui fera flamma micat,  
Ipse Gaberbocchus dumeta per horrida sifflans  
Ibat, et horrendum burbuliabat iens!

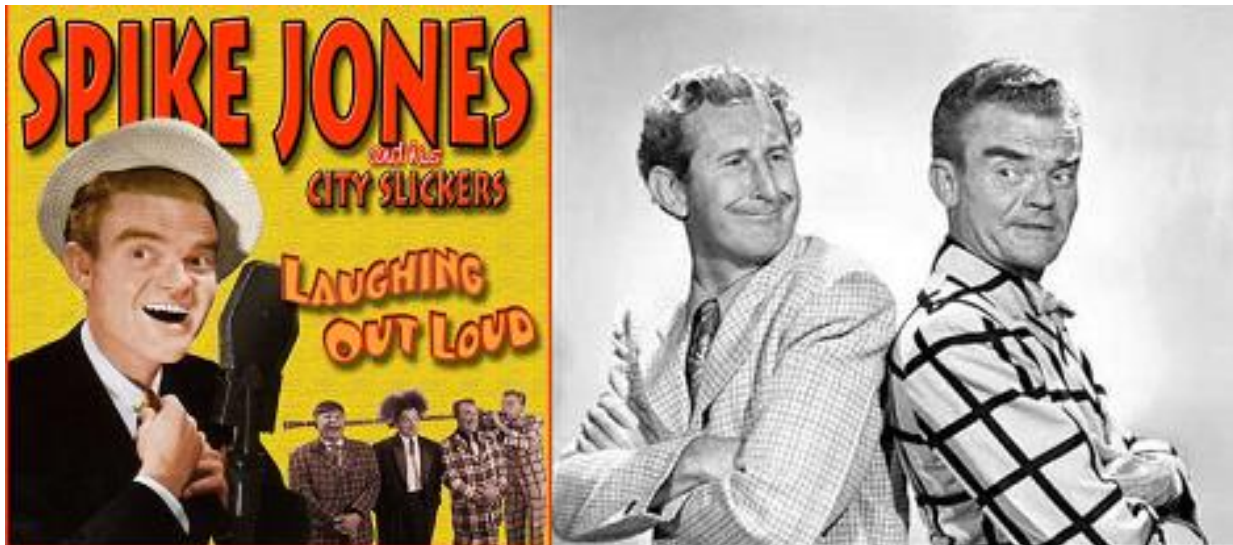
Ter, quarter, atque iterum cito vorpalissimus ensis  
Snicsnaccans penitus viscera dissecuit.  
Exanimum corpus linquens caput abstulit heros  
Quocum galumphat multa, domumque redit.

"Tune Gaberbocchum potuisti, nate, necare?  
Bemiscens puer! Ad brachia nostra veni.  
Oh! Frabiusce dies! Iterumque caloque calque  
Laetus eo" ut chortlet chortla superba senex.

Hora aderat briligi. Nunc et Slythia Tova  
Plurima gyrabant gymbolitare vabo;  
Et Borogovororum mimzebant undique formae,  
Momiferique omnes exgrabure Rathi.

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## Spike Jones and His City Slickers



Lindley Armstrong Jones specialized in spoof arrangements of popular songs and classical music. Ballads receiving the Jones treatment were punctuated with gunshots, whistles, cowbells and outlandish and comedic vocals.

World War II audiences embraced Spike and his City Slickers ("the Band who played for fun") for their delicious parodies of popular songs; some of their best being "Der Fuehrer's Face", "Cocktails for Two", which included a chorus of hiccupping, and "You Always Hurt the One You Love", which was dominated by a series of shootings, hangings and poisonings.

Doodles Weaver [aka the Mad Monk] who's zany exploits remain a brilliant stain on the august reputation of Stanford University, was responsible for some of Spike's greatest skits.

Spike Jones Musical Medley (TV Show 1952)

<https://www.youtube.com/watch?v=Be7O9g2sphw>

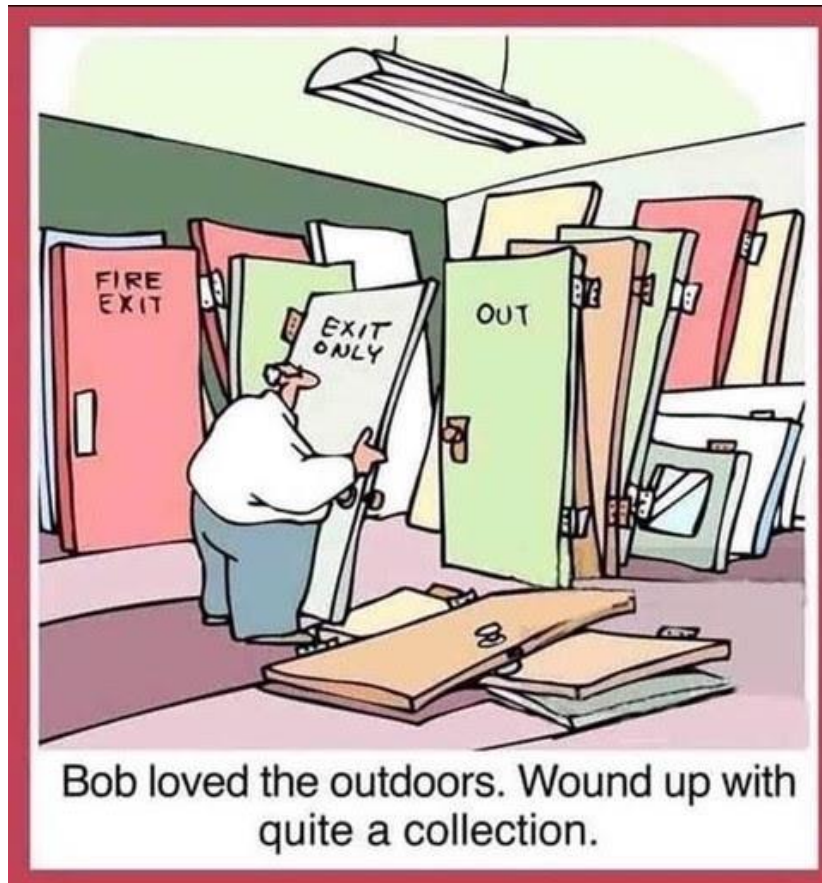
William Tell Overture; Beetlebaum

<https://www.youtube.com/watch?v=bv51VtTADys>

Hawaiian War Chant

<https://www.youtube.com/watch?v=Be7O9g2sphw>

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## Have You Ever Seen a Soap Bubble Freeze?

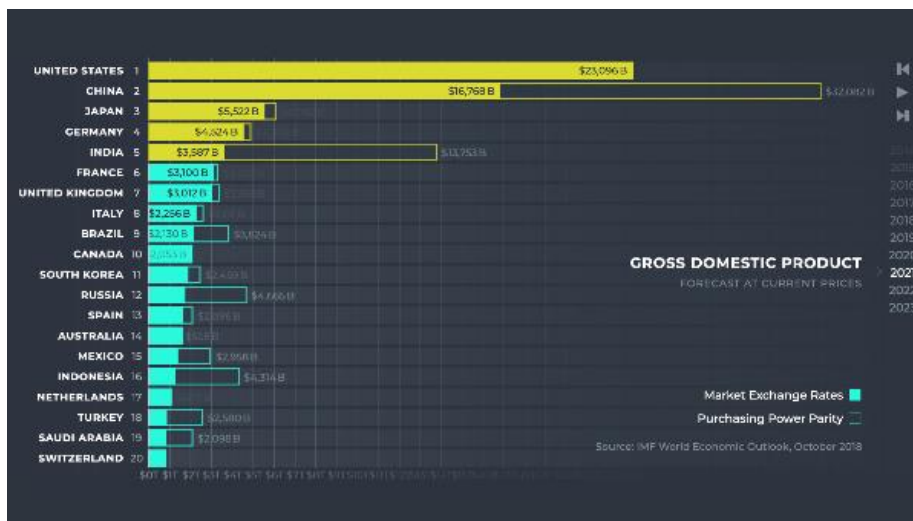


[https://youtu.be/33f8G\\_FnYng](https://youtu.be/33f8G_FnYng)

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## Animated: Top 20 Countries by GDP (1995-2023E)

By Iman Ghosh for The Trendline Via Lowy Institute



In this bar chart race, The Lowy Institute uses data from the International Monetary Fund to paint a picture of global growth, dating back to 1995 and projecting into 2023.

<https://interactives.lowyinstitute.org/charts/api/gdp-vs-ppp/>

Press to watch these superpowers fight it out on the leaderboard—the top 20 countries are ranked by their annual gross domestic product (GDP) in both nominal and PPP terms. In particular, it's mesmerizing to watch China's rapid ascent through the 2000s.

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## For Those Who Thought Beer Bottles Were Passe'

Michael Jackson Billie Jean Remix with Bottles

<https://www.youtube.com/watch?v=VAySXYqbc8M&t=41s>



The Melbourne Symphony orchestra, conducted by Cezary Skubiszewski, play the Victoria Bitter beer commercial theme song

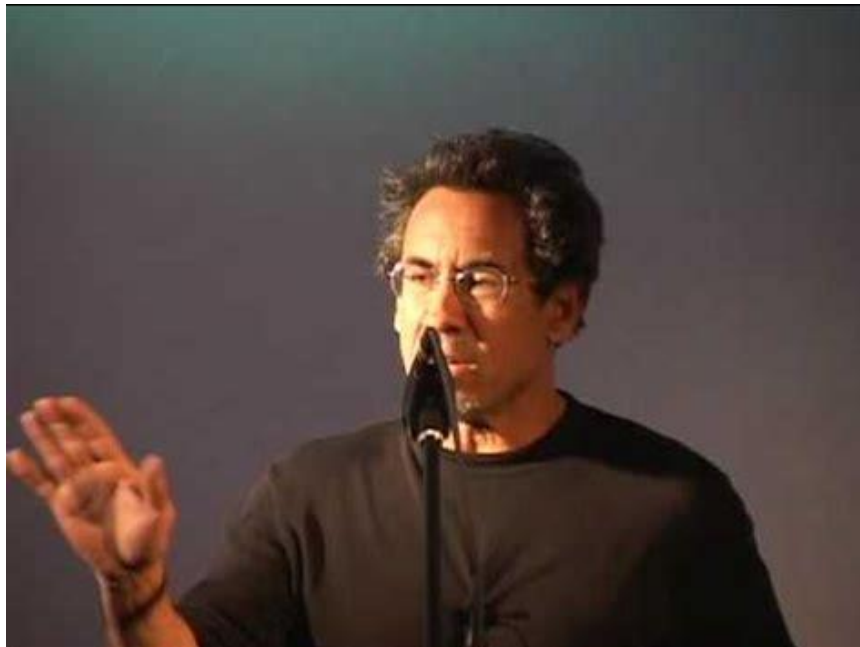
<https://www.youtube.com/watch?v=pUru7nSyKxQ>

The St. Luke's Bottle Band: William Tell Overture

<https://www.youtube.com/watch?v=2-VOPxSYJr8>

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## Dan Yashinsky: My Bubbie and the Police



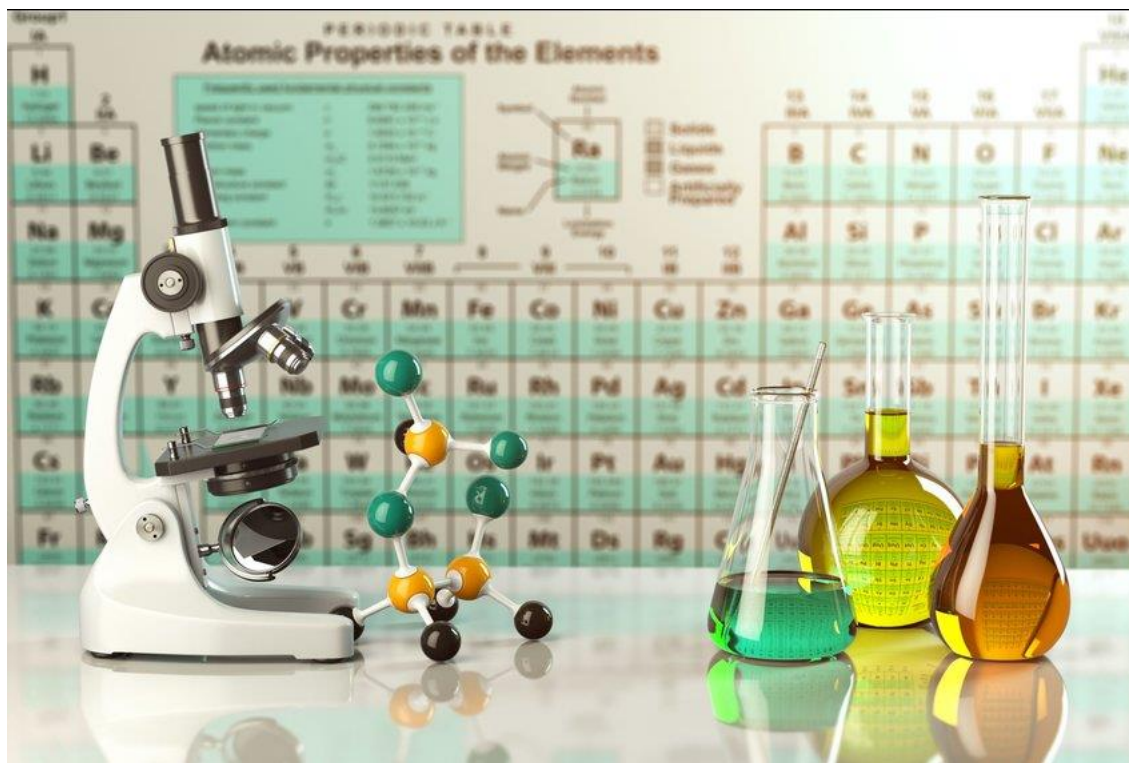
<https://www.youtube.com/watch?v=VnJ9B6PtZwQ>

This is a story about Dan's grandmother and the power of words and stories that can make a difference

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## Science Marches On

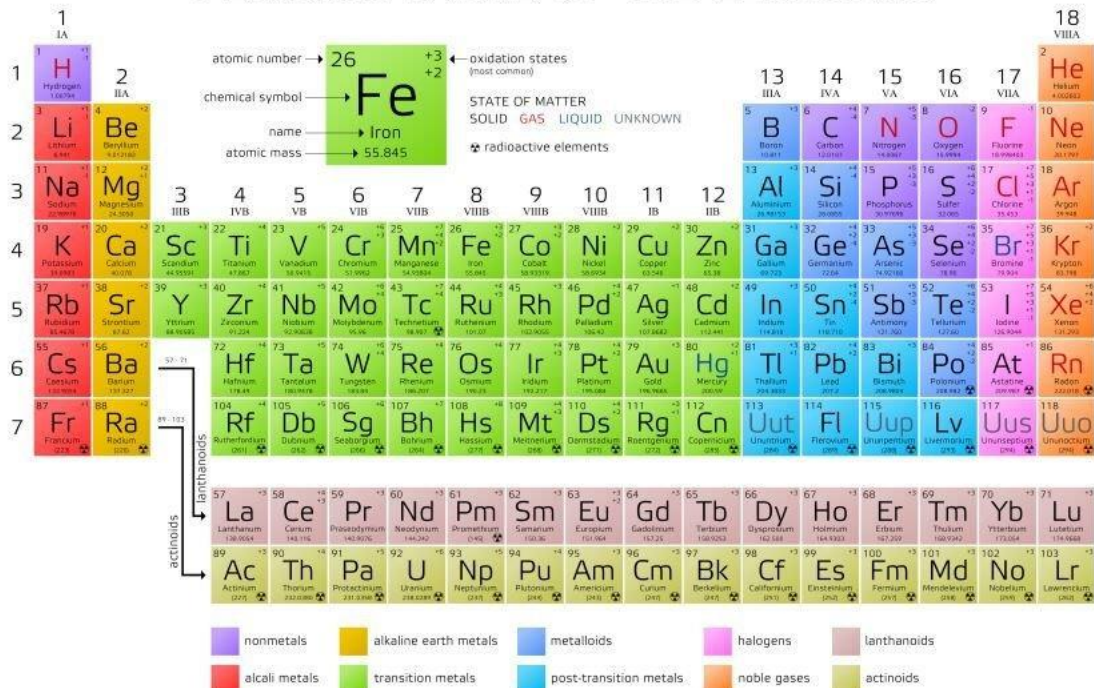
## The 4 Newest Elements On the Periodic Table



Remember how much fun you had memorizing the periodic table with its abbreviations, groups, and periods? Great! Because there are four more elements to add to the middle-school nightmares of your children and grandchildren. In December 2015, four new elements were added by the International Union of Pure and Applied Chemistry (IUPAC) to the periodic table. Nihonium (Nh), Moscovium (Mc), Tennessine (Ts), and Oganesson (Og) made their entries to the table as elements 113, 115, 117, and 118, respectively. Here's the lowdown on these new additions.

### Refresher

# PERIODIC TABLE OF THE ELEMENTS



*Credit: andriano dot cz / Shutterstock.com*

The periodic table of elements organizes chemical elements by their atomic number, electron configuration, and chemical properties. The first step toward the construction of the table came in the form of a list of 33 elements published by Antoine Lavoisier in 1789. One century later, Dmitri Mendeleev put together the first periodic table of elements grouped with properties and leaving blank spaces for (what he rightly assumed were) undiscovered ones.

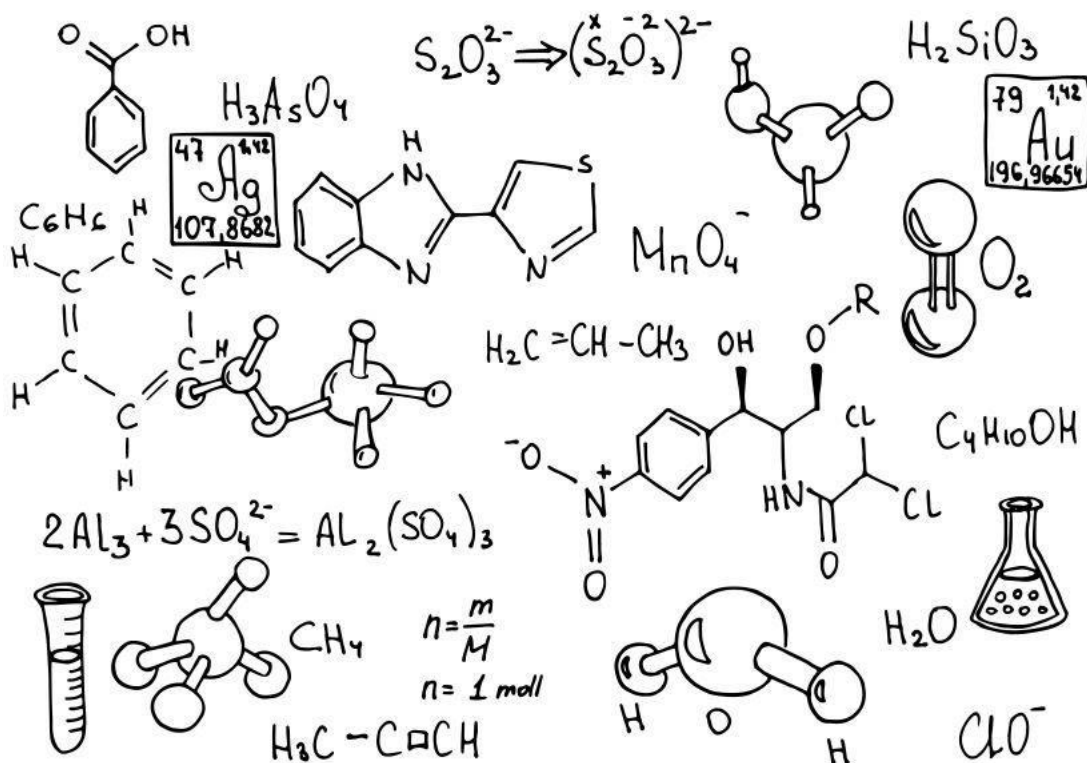
## Progress

By 1940, chemists had discovered all naturally occurring elements, including plutonium, neptunium, and astatine. These last three elements were initially synthesized in a lab before being observed in nature. These were likely the last elements that we would observe outside of a laboratory because increasing the number of protons in an atomic nucleus leads to instability. These larger elements quickly lose their protons through radiation to degrade to a smaller element.

However, an interesting property of the synthetic elements is observed when, by increasing proton number, the usually unstable intermediaries will show “islands of stability” where the nucleus remains intact for substantially longer than in intermediates. Element 117 was one of the first discovered islands of stability. Its decay chain isotope, lawrencium-266, showed a half-life of 11 hours, which is exponentially longer than elements of similar atomic weight.

## Something old, something new





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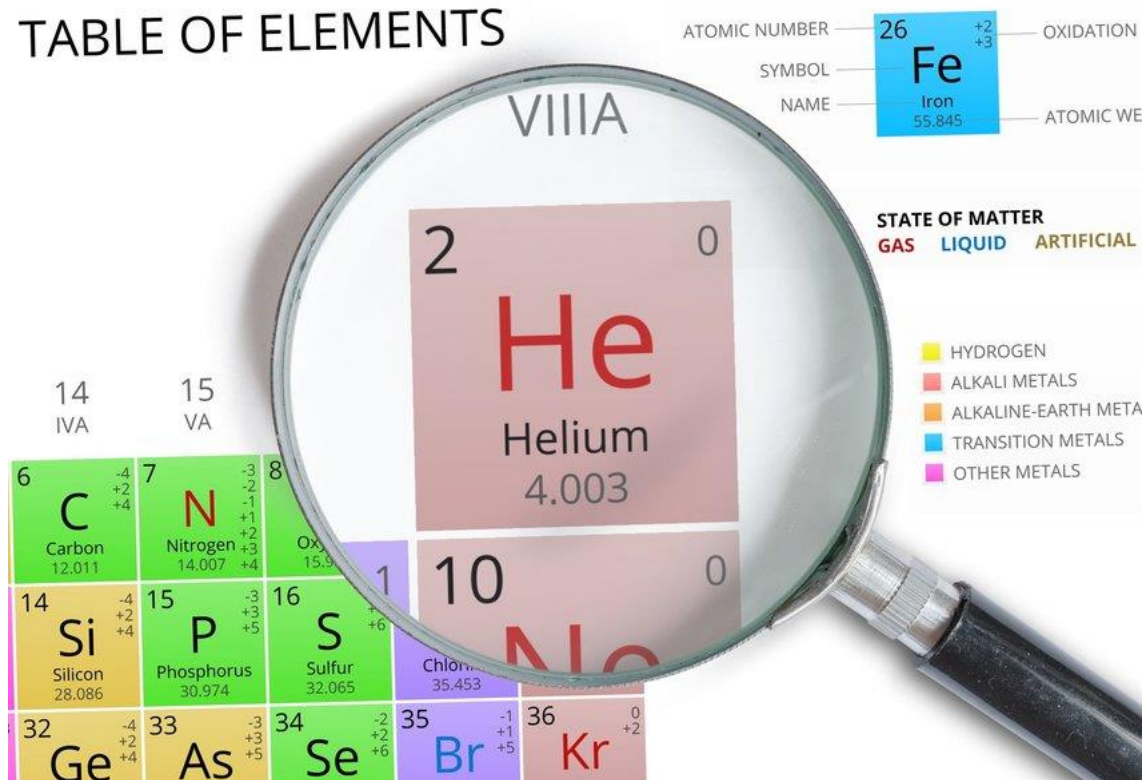
"Newly" discovered is a relative term. Of the upcoming additions to the periodic table, several were synthesized in the early 2000s. However, before being incorporated into the table with IUPAC approval, the elements needed to be demonstrated to be reproducible. It has taken nearly a decade to demonstrate that these four elements are.

### What's in a name?

The IUPAC standards set the ground rules for naming elements: they must refer to a scientist, mythology, substance, chemical property, or place. Of the newly incorporated elements, three follow the final rule. Tennessine, Moscovium, and Nihonium refer to the locale of the laboratory in which the elements were discovered: Tennessee, Moscow, and Japan. Oganesson takes the namesake of Russian nuclear physicist Yuri Oganessian at the Joint Institute for Nuclear Research, the same lab in which Moscovium was discovered. Oganesson is only the second element on the periodic table to be named after a person. Seaborgium is the other element, named after Glenn Seaborg.

### Noble solid

# TABLE OF ELEMENTS



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Of the new elements, Oganesson is perhaps the most interesting. It is the heaviest known element to date and falls into the group of noble gases, which are odorless, colorless, and inert. Oganesson's chemistry is still left to be studied, but it appears to exhibit properties of the noble gases with the exception of the fact that it is a solid.

## What's next?

Chemists will continue to synthesize elements exhibiting transitory states with short half-lives. It is expected that a new island of stability will be discovered with continued synthesis producing a superstable element that could last anywhere between minutes to millennia. The next superstable element is expected to occur at element 126, and though it's impossible to envision the properties of a yet-to-be-discovered substance, the industrial applications of such an element could revolutionize science with possibilities for innovation in nuclear energy.

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