

Ode to E Pluribus Unum for Sunday October 8 2023

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Arp 93: A Cosmic Embrace



Image Credit & Copyright: Mike Selby, Observatorio El Sauce

Locked in a cosmic embrace, two large galaxies are merging at the center of this sharp telescopic field of view.

The interacting system cataloged as Arp 93 is some 200 million light-years distant toward the constellation Aquarius in planet Earth's sky.

Individually the galaxies are identified as NGC 7285 (right) and NGC 7284. Their bright cores are still separated by about 20,000 light-years or so, but a massive tidal stream, a result of their ongoing gravitational interaction, extends over 200,000 light-years toward the bottom of the frame.

Interacting galaxies do look peculiar, but are now understood to be common in the Universe. In fact, closer to home, the large spiral Andromeda Galaxy is known to be approaching the Milky Way. Arp 93 may well present an analog of their distant future cosmic embrace.

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Pythagorean Theorem Found On Clay Tablet 1,000 Years Older Than Pythagoras

It predates Pythagoras by over 1,000 years.

By James Felton for IFL Science News



The proof is carved into clay.

Image credit: Osama Shukir Muhammed Amin FRCP(Glasg) via Wikimedia Commons (CC BY-SA 4.0); rotated, cropped

Study math for long enough and you will likely have cursed Pythagoras's name, or said "praise be to Pythagoras" if you're a bit of a fan of triangles.

But while Pythagoras was an important historical figure in the development of mathematics, he did not figure out the equation most associated with

him ($a^2 + b^2 = c^2$). In fact, there is an ancient Babylonian tablet (*by the catchy name of IM 67118*) which uses the Pythagorean theorem to solve the length of a diagonal inside a rectangle. The tablet, likely used for teaching, dates from 1770 BCE – centuries before Pythagoras was born in around 570 BCE.

Another tablet from around 1800–1600 BCE has a square with labeled triangles inside. Translating the markings from base 60 – the counting system used by ancient Babylonians – showed that these ancient mathematicians were aware of the Pythagorean theorem (not called that, of course) as well as other advanced mathematical concepts.

"The conclusion is inescapable. The Babylonians knew the relation between the length of the diagonal of a square and its side: $d = \text{square root of } 2$," mathematician Bruce Ratner writes in a paper on the topic. "This was probably the first number known to be irrational. However, this in turn means that they were familiar with the Pythagorean Theorem – or, at the very least, with its special case for the diagonal of a square ($d^2 = a^2 + a^2 = 2a^2$) – more than a thousand years before the great sage for whom it was named."

So why did this get attributed to Pythagoras? No original writing from Pythagoras survives. What we know of him was passed on by others, in particular the Pythagoreans – members of a school he set up in what is now modern-day southern Italy. The school, named the Semicircle of Pythagoras, was secretive, but knowledge learned there or discovered was passed on, and often attributed to the man himself.

"One reason for the rarity of Pythagoras original sources was that Pythagorean knowledge was passed on from one generation to the next by word of mouth, as writing material was scarce," Ratner continued. "Moreover, out of respect for their leader, many of the discoveries made by the Pythagoreans were attributed to Pythagoras himself; this would account for the term 'Pythagoras' Theorem'."

Though Pythagoras did not come up with the theory, his school certainly popularized it, and it became associated with him for the next few thousand years, at least.

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The Himalayas Had a Leg Up Before the Plates Collided



A new technique for measuring past topography shows the Himalayas were more than halfway there before a continental collision made them the highest range in the world.

<https://bit.ly/3KHUEXo>

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Physicists Move One Step Closer to a Theoretical Showdown

The deviance of a tiny particle called the muon might prove that one of the most well-tested theories in physics is incomplete.



The Fermilab particle accelerator complex. Credit...Reidar Hahn/Fermilab, via US Department of Energy

On July 24, a large team of researchers convened in Liverpool to unveil a single number related to the behavior of the muon, a subatomic particle that might open a portal to a new physics of our universe.

All eyes were on a computer screen as someone typed in a secret code to release the results. The first number that popped out was met with exasperation: a lot of concerning gasps, oh-my-God's and what-did-we-do-wrong's. But after a final calculation, "there was a collective exhale across multiple continents," said Kevin Pitts, a physicist at Virginia Tech who was five hours away, attending the meeting virtually. The new measurement matched exactly what the physicists had computed two years prior — now with twice the precision.

So comes the latest result from the Muon g-2 Collaboration, which runs an experiment at Fermi National Accelerator Laboratory, or Fermilab, in Batavia, Ill., to study the deviant motion of the muon. The measurement, announced to the public and submitted to the journal *Physical Review Letters* on Thursday morning, brings physicists one step closer to figuring out if there are more types of matter and energy composing the universe than have been accounted for.

"It really all comes down to that single number," said Hannah Binney, a physicist at the Massachusetts Institute of Technology's Lincoln Laboratory who worked on the muon measurement as a graduate student.

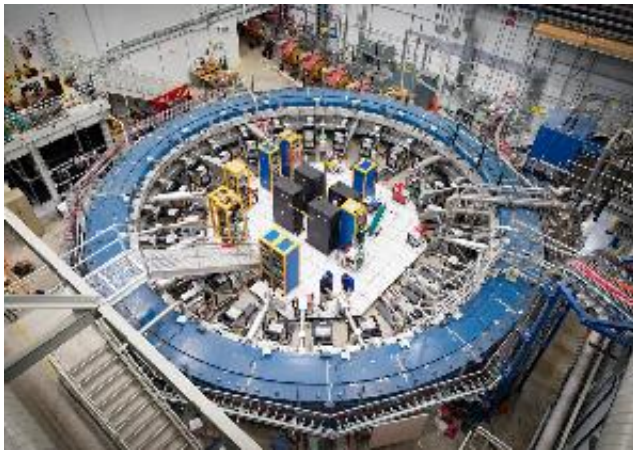
Scientists are putting to the test the Standard Model, a grand theory that encompasses all of nature's known particles and forces. Although the Standard Model has successfully predicted the outcome of countless experiments, physicists have long had a hunch that its framework is incomplete. The theory fails to account for gravity, and it also can't explain dark matter (the glue holding our universe together), or dark energy (the force pulling it apart).

One of many ways that researchers are looking for physics beyond the Standard Model is by studying muons. As heavier cousins of the electron, muons are unstable, surviving just two-millionths of a second before decaying into lighter particles. They also act like tiny bar magnets: Place a muon in a magnetic field, and it will wobble around like a top. The speed of that motion depends on a property of the muon called the magnetic moment, which physicists abbreviate as g .

In theory, g should exactly equal 2. But physicists know that this value gets ruffled by the "quantum foam" of virtual particles that blip in and out of existence and prevent empty space from being truly empty. These transient particles change the rate of the muon's wobble. By taking stock of all the forces and particles in the Standard Model, physicists can predict how much g will be offset. They call this deviation $g-2$.

But if there are unknown particles at play, experimental measurements of g will not match this prediction. "And that's what makes the muon so exciting to study," Dr.

Binney said. “It’s sensitive to all of the particles that exist, even the ones that we don’t know about yet.” Any difference between theory and experiment, she added, means new physics is on the horizon.



The Muon g-2 ring at the Fermilab particle accelerator complex in Batavia, Ill. Credit...

To measure $g-2$, researchers at Fermilab generated a beam of muons and steered it into a 50-foot-diameter, doughnut-shaped magnet, the inside brimming with virtual particles that were popping into reality. As the muons raced around the ring, detectors along its edge recorded how fast they were wobbling.

Using 40 billion muons — five times as much data as the researchers had in 2021 — the team measured $g-2$ to be 0.00233184110, a one-tenth of 1 percent deviation from 2. The result has a precision of 0.2 parts per million. That’s like measuring the distance between New York City and Chicago with an uncertainty of only 10 inches, Dr. Pitts said.

“It’s an amazing achievement,” said Alex Keshavarzi, a physicist at the University of Manchester and a member of the Muon $g-2$ Collaboration. “This is the world’s most precise measurement ever made at a particle accelerator.” The results, when revealed to the public at a scientific seminar on Thursday morning, were met with applause.

“The kind of precision that these people have managed to attain is just staggering,” said Dan Hooper, a theoretical cosmologist at the University of Chicago who was not involved in the work. “There was a lot of skepticism they would get here, but here they are.”

But whether the measured $g-2$ matches the Standard Model’s prediction has yet to be determined. That’s because theoretical physicists have two methods of computing $g-2$, based on different ways of accounting for the strong force, which binds together protons and neutrons inside a nucleus.

The traditional calculation relies on 40 years of strong-force measurements taken by experiments around the world. But with this approach, the $g-2$ prediction is only as good as the data that are used, said Aida El-Khadra, a theoretical physicist at the

University of Illinois Urbana-Champaign and a chair of the Muon $g-2$ Theory Initiative. Experimental limitations in that data, she said, can make this prediction less precise.

A newer technique called a lattice calculation, which uses supercomputers to model the universe as a four-dimensional grid of space-time points, has also emerged. This method does not make use of data at all, Dr. El-Khadra said. There's just one problem: It generates a $g-2$ prediction that differs from the traditional approach.

"No one knows why these two are different," Dr. Keshavarzi said. "They should be exactly the same."

Compared with the traditional prediction, the latest $g-2$ measurement has a discrepancy of over 5-sigma, which corresponds to a one in 3.5 million chance that the result is a fluke, Dr. Keshavarzi said, adding that this degree of certainty was beyond the level needed to claim a discovery. (That's an improvement from their 4.2-sigma result in 2021, and a 3.7-sigma measurement done at Brookhaven National Laboratory near the turn of the century.)

But when they compared it with the lattice prediction, Dr. Keshavarzi said, there was no discrepancy at all.

Rarely in physics does an experiment surpass the theory, but this is one of those times, Dr. Pitts said. "The attention is on the theoretical community," he added. "The limelight is now on them."

Dr. Binney said, "We are on the edge of our seats to see how this theory discussion pans out." Physicists expect to better understand the $g-2$ prediction by 2025.

Gordan Krnjaic, a theoretical particle physicist at Fermilab, noted that if the experimental disagreement with theory persisted, it would be "the first smoking-gun laboratory evidence of new physics," he said. "And it might well be the first time that we've broken the Standard Model."

While the two camps of theory hash it out, experimentalists will hone their $g-2$ measurement further. They have more than double the amount of data left to sift through, and once that's included, their precision will improve by another factor of two. "The future is very bright," said Graziano Venanzoni, a physicist at the University of Liverpool and one leader of the Muon $g-2$ experiment, at a public news briefing about the results.

The latest result moves physicists one step closer to a Standard Model showdown. But even if new physics is confirmed to be out there, more work will be needed to figure out what that actually is. The discovery that the known laws of nature are incomplete would lay the foundation for a new generation of experiments, Dr. Keshavarzi said, because it would tell physicists where to look.

“Physicists get really excited when theory and experiment do not agree with each other,” said Elena Pinetti, a theoretical physicist at Fermilab who was not involved in the work. “That’s when we really can learn something new.”

For Dr. Pitts, who has spent nearly 30 years pushing the bounds of the Standard Model, proof of new physics would be both a celebratory milestone and a reminder of all that is left to do. “On one hand it’s going to be, Have a toast and celebrate a success, a real breakthrough,” he said. “But then it’s going to be back to work. What are the next ideas that we can get to work on?”

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How Do You Know You’ve Mastered a Language?

Here are some sensible responses.

- “I knew I’d reached a French milestone when I could understand my neighbor’s hallway fights with her boyfriend.”—Elizabeth from Washington, DC
- “When you get pulled over for a traffic violation and you can nervously stammer your way out of it in the local tongue.”—Mark from Houston, TX (*I failed this one*)
- “When you smash your foot into something, and the resulting profanity that follows is not in English.”—Josh from Shenzhen, China
- “After 10 years of marriage to a German, I know the answer: It’s when you are super mad about something and can still form a clear and convincing argument.”—Lizzy from Munich, Germany
- “I could be a Dungeon Master for a D&D campaign with that language.”—Phillip from the Bronx
- “When you can comfortably flirt and enjoy it!”—Shayda from CA

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5 Megabytes in 1955



How many trees would you need for a gigabyte?

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Richard Feynman (1918-1988) on Mathematics



Feynman developed a widely used pictorial representation scheme for the mathematical expressions describing the behavior of subatomic particles, which later became known as Feynman diagrams. During his lifetime, Feynman became one of the best-known scientists in the world. In a 1999 poll of 130 leading physicists worldwide by the British journal Physics World, he was ranked the seventh-greatest physicist of all time.

<https://youtu.be/YaUlgXRPMmY>

Feynman's Lost Lecture (ft. 3Blue1Brown) <https://youtu.be/xdIjYBtvZU>

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Next Year's Paint Trends are Looking a Lot Like Barbenheimer

Sherwin-Williams predicts the temperature is warming up and cooling down in the color direction.



"This Barbie pop-culture moment is not showing any signs of slowing down, and in the color direction too the temperature is really warming up," says Sue Wadden, the color marketing director at Sherwin-Williams,

<https://bit.ly/3KQg04S>

Yuch-oh!

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Yelp's Top 100 US Taco Spots 2023

Find out where to eat the best tacos in 2023, and check out our list of the Top 15 Taco Towns across the US



*Numero Uno, Aroma Latin American Cocina, Henderson, Nevada
restaurantjump*

It's taco time! No need to wait till Tuesday to get your birria, carne asada, or al pastor fix. Tacos are an everyday comfort food across the US, with billions sold every year in restaurants, taco trucks, fast-food joints, and more.

<https://bit.ly/3RKfKZI>

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This Fish Sees with Its Eyes and Skin.



Pointy-snouted reef fish called the hogfish can change from white to spotted brown to reddish depending on its surroundings.

Photo courtesy of Dean Kimberly and Lori Schweikert.

In 2018, Schweikert and Duke biologist Sönke Johnsen published a study showing that hogfish carry a gene for a light-sensitive protein called opsin that is activated in their skin, and that this gene is different from the opsin genes found in their eyes.

<https://bit.ly/3EcOxGT>

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Clone a Lisa



Paint your own forgery in 60 seconds?

<https://bit.ly/47ZUmW2>

Well, I failed, but maybe you can do better.

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One Man's Quest to End Cheating in Virtual Cycling



*Riders compete on a course in Zwift's Watopia metaverse.
(Zwift)*

A cyclist discovered widespread cheating on the popular online cycling platform Zwift. Then came the death threats.

<https://bit.ly/3PVgae7>

Oh, no. Don't tell me there's skullduggery in the goody-two-shoes world.

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Video Captures a Rarely Seen Sperm Whale Birth. It's Beautiful.



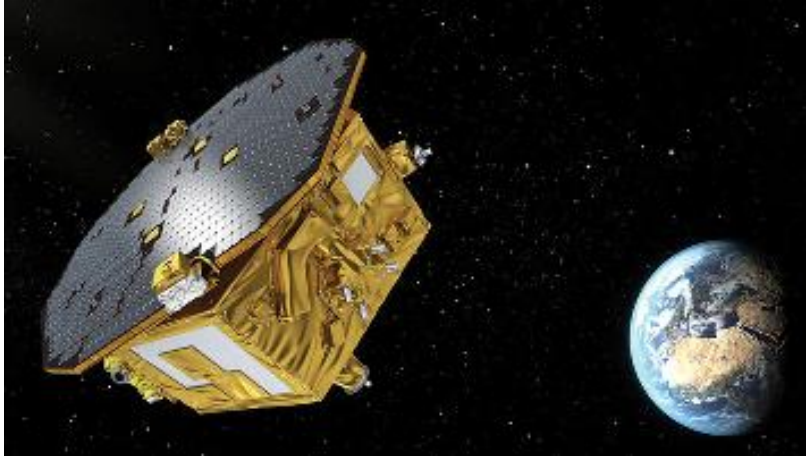
The last scientific record of a sperm whale birth was 1986, without audio or video. New recordings of the whales' behavior during the birth will give researchers new insight.

<https://bit.ly/3sOBf0V>

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Newton's Gravitational Constant Still Can't Be Pinned Down

Different labs' measurements of the strength of gravity don't agree.



Though designed and launched for other purposes, the LISA Pathfinder mission measured the distance between two objects in free fall in a spacecraft (illustrated) well enough to find G to within about one part in 15. This proof of concept suggests G can be measured without the interference of Earth's gravity.

ESA

<https://bit.ly/43RiyX4>

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Brown Confirmed as Chair of Joint Chiefs of Staff



Image: U.S. Air Force

U.S. Air Force Chief of Staff General Charles Q. Brown was confirmed by the U.S. Senate as chairman of the Joint Chiefs of Staff on Wednesday. He succeeds Army General Mark Milley, who has held the position since October 2019. An F-16 pilot with more than 3,000 flight hours, Brown has logged 130 combat hours and flown 20 additional aircraft types.

Before becoming Chief of Staff of the Air Force, he was commander of the Pacific Air Forces (PACAF), air component commander for U.S. Indo-Pacific Command and executive director of the Pacific Air Combat Operations Staff.

Commissioned in 1984, Brown has previously served as an F-16 instructor at the U.S. Air Force Weapons School, Aide-de-Camp to the Chief of Staff of the Air Force, director of the Secretary of the Air Force and Chief of Staff executive action group and deputy commander of U.S. Central Command.

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Inside a Futuristic Home with Removable Rooms



Architectural Digest

Today Architectural Digest tours a futuristic home nestled among the trees in Malibu, California. If you were to imagine life on Mars your mind might conjure an image similar to this extraordinary residence. Built by architect Ed Niles in 1992, his experimental builds have been redefining the architecture of Southern California for decades. The innovative design features a long structure with modular rooms that can be unhooked and rearranged along the house's spine. Join Ed as he talks you through the creative process behind this architectural marvel.

<https://youtu.be/JKktQzZis4c>

An interesting project. I wish Niles wasn't quite so off-putting.

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Elizabeth Tower's Big Ben

Elizabeth Tower (Big Ben) is the famous clock tower in London, England. Come see how it works!



https://youtu.be/H3xgBS_kDNw?t=26

Cage-Free vs. Free Range—Egg Carton Labels—Explained



With eggs at super-high prices, you want to make sure you're getting what you think you're paying for

<https://bit.ly/3PAM9io>

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11 Vitamin D Myths and Facts

How much do you really know about the sunshine vitamin?



With the possible exception of C, there's perhaps no vitamin more frequently discussed than the sunshine one — aka vitamin D.

<https://bit.ly/3RA3ta3>

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Swords of the World from Every Corner of the Globe



Welcome to the world of swords! Attempting to compile an extensive list of the world's various sword types would be an enormous undertaking simply because there might be one too many of them. But fear not, for we here at SwordEncyclopedia have made it our mission to assist your exploration of the fascinating world of swords. Each sword type will be sorted into a category according to the continent on which it was made.

<https://swordencyclopedia.com/types-of-swords/>

All you wanted to know about swords...and maybe a tiny bit more.

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Mike Rowe: The Missing 7.2 Million Male Workers



The Dirty Jobs host is freaked out by the number of men who have dropped out of the workplace.

Mike Rowe, the bestselling author, Emmy winner, and podcaster is best known for his stint hosting The Discovery Channel's long-running Dirty Jobs, where he performed the sort of work we all rely on but don't want to think about too much.

From cleaning septic tanks to putting hot tar on roofs to disposing of medical waste, he's done it all—and loves to talk about the value of the hard, honest work that he thinks is devalued by a society fixated on sending everyone to college. Reason Magazine's Nick Gillespie caught up with Rowe at FreedomFest, an annual gathering held this year in Memphis.

They talked about how his mikeroweWORKS Foundation matches young people interested in learning trades with employers dying for applicants, why men continue to fall further behind women in school and work, and how Rowe's booze brand Knobel Spirits, named after his maternal grandfather, is fueling his nonprofit's impact.

<https://youtu.be/x17ip3ZwG0Q?t=2>

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Take a Scenic Ride on an Alpine Coaster



Join us for an exhilarating ride like no other near the picturesque town of Oberammergau, nestled in the breathtaking German Alps. Our Alpine coaster promises an adrenaline-pumping journey covering an impressive 2,600 meters, all while treating you to awe-inspiring vistas of the majestic mountain landscape.

<https://youtu.be/mWZipukcDd4>

Holy moly. This one's in Germany but there are others around the globe.

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Preparing for 2024

If God wanted us to vote, he would have given us candidates.

~Jay Leno~

The problem with political jokes is they get elected.

~Henry Cate, VII~

We hang the petty thieves and appoint the great ones to public office

~Aesop~

Politicians are the same all over. They promise to build a bridge even where there is no river.

~Nikita Khrushchev~

When I was a boy I was told that anybody could become President; I'm beginning to believe it.

~Clarence Darrow~

Politicians are people who, when they see light at the end of the tunnel, go out and buy some more tunnels.

~John Quinton~

Why pay money to have your family tree traced; go into politics and your opponents will do it for you.

~Author unknown~

Politics is supposed to be the second-oldest profession. I have come to realize that it bears a very close resemblance to the first.

~Ronald Reagan~

Politics is the gentle art of getting votes from the poor and campaign funds from the rich, by promising to protect each from the other.

~Oscar Ameringer~

I offer my opponents a bargain: if they will stop telling lies about us, I will stop telling the truth about them.

~Adlai Stevenson, 1952~

A politician is a fellow who will lay down your life for his country.

~Tex Guinan~

Instead of giving a politician the keys to the city, it might be better to change the locks.

~Doug Larson~

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Chicago Woman Becomes World's Oldest Skydiver at 104'

"The whole thing was delightful, wonderful," centenarian Dorothy Hoffner said of her historic jump.



<https://bit.ly/46g6bpJ>

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My Walking Thoughts



For Sunday October 8 2023

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