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DevSecOps: Centralized Defense mechanism

Today we see that data and silos are the 2 weakest links. The two weakest links

DATA and S.I.L.O.S

When it comes to data science, most organizations work in silos or putting their entire team effort to achieve the result. So how we bring the defense layer in the entire data layer. What we need here is,

1. Orchestrate DevSecOps across the entire development teams.
2. To reduce the deployment time from many weeks to few hours for data processing applications.
3. Data governance policies and security policies are automated through the data governance pipeline.
4. The silos user should continuously innovate without being worried about security policies and security of their data.

So, let us understand how we can implement DevSecOps in entire Data life cycle. To implement a secure environment, an organization should follow:

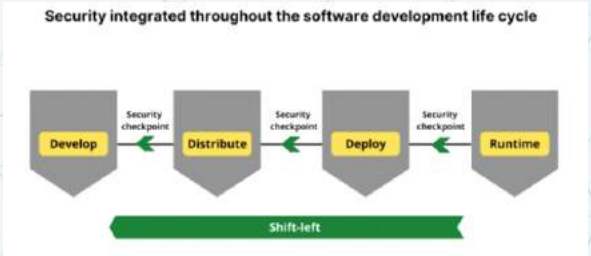
- The principle of security
- The principle of least privilege
- The principle of defense in depth and
- Securing the weakest link.

The principle of least privilege means that the member should be given minimum required access only. Root access should not be given to every user if it is not necessary for them. So, coming to what is this weakest link. It is the security component or functionality that does not overlap. So, if we have a weak component in the whole organization; that component is most likely to be attacked by the external attacker. And this is the component that should be secured first. So, the defense in depth principle implements redundant security measures. Thus, the collective security offered is the more important than single components. Any vulnerability not caught by one component will be called by another.

So, there is a foundational security layer; on top of which comes the **DEVSECOPS** layer. This is the layer which was not thought in the data world earlier.

This layer ensures that the **'SHIFT LEFT SECURITY'** is the culture of the organization.

So, during development stage itself the developers are made aware of the consequences of their less secure code in the production environment. They are educated, trained; even when they are working in the development environment; they are taught on this concept of **'Shift left security'**.



With the continuous feedback in the continuous DevOps pipeline, developers get instant feedback on the security scans run on their code. It is worth spending few extra hours during the development phase; implementing the best security practices, rather than spending millions to pay fines on production.

The conclusion is that data should be secured continuously with **DEVSECOPS**.

A different kind of solar power attracts attention

Concentrated solar-thermal power, which uses mirrors to reflect and concentrate the sun's energy, isn't ready for prime time...yet

When you think of solar energy, you probably picture the photovoltaic panels that capture sunlight to be converted to electricity. But there are other ways to harness the sun's power. One method attracting growing interest is called concentrated solar-thermal power, or CSP, which uses mirrors to reflect and concentrate the sun's energy.

CSP has been held back by technical challenges and a shortage of funding and government incentives compared with other sources of renewable energy. But as the sense of urgency about replacing fossil fuels continues to grow, spurring demand for carbon-free energy, a number of increasingly well-funded entities are trying to improve the technology. Proponents say the heat that CSP systems produce and their storage capacity offer advantages over other renewables for generating grid-scale electricity and fuelling various industrial processes.

Snap launches a $230 flying camera called Pixy

It's best known for its social media app, Snapchat, but Snap has today launched a new piece of hardware – a flying camera. The flying camera, called Pixy, was unveiled at Snap's Partner Summit today, and is described as a 'free-flying sidekick that's a fit for adventures big and small.'

Pixy does not require a controller or any set-up, and instead operates on its own, snapping selfies for you before landing in your palm. With a price tag of $229.99, Pixy is designed to be a companion to Snapchat, with videos filmed wirelessly transferring and saving into the Snapchat app.

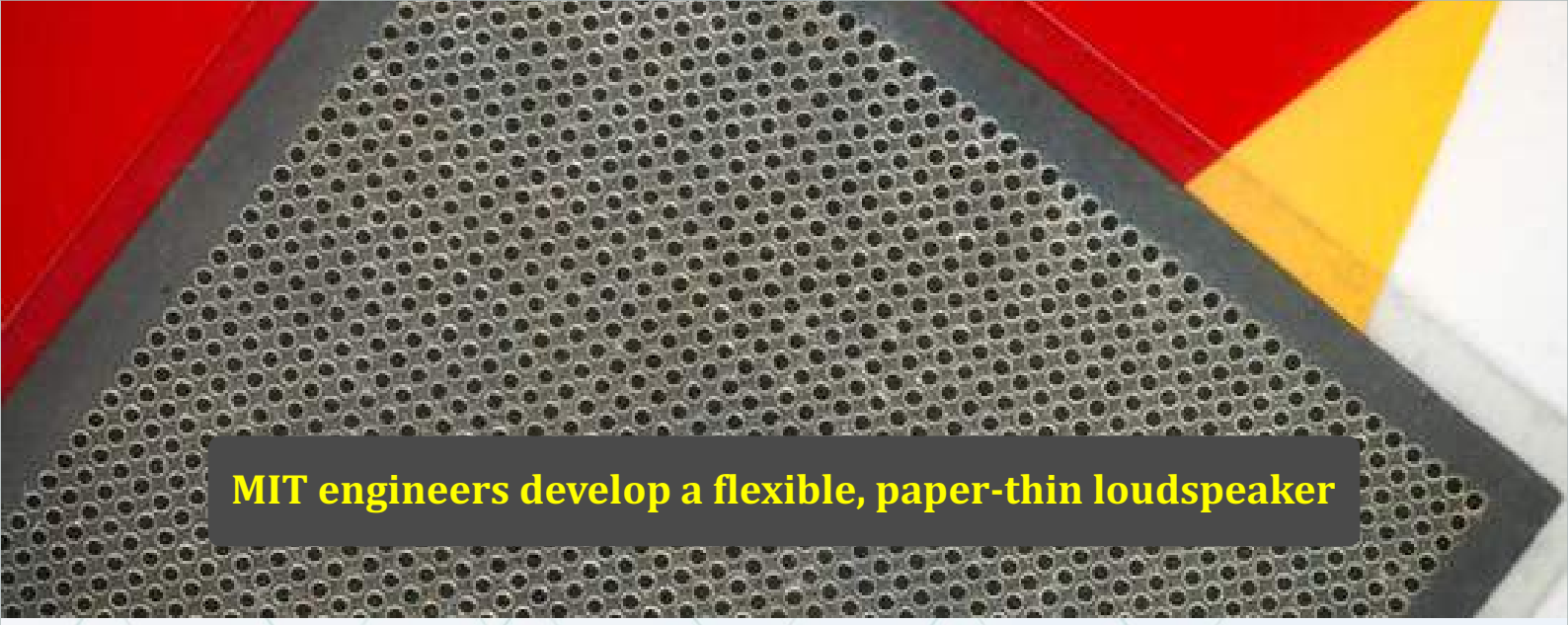
Evan Spiegel, co-founder and CEO of Snap, said: 'Everything you need to capture the spontaneity and fun of the moment from new perspectives is right in the palm of your hand. With the simple tap of a button, Pixy takes flight and joins you on your journey.'

Speaking at Snap's Partner Summit, Mr Spiegel explained why Snap decided to develop the flying camera.
'We first created Snapchat as a new way to use the Camera for self-expression and communication,' he explained.
From Lenses to Spectacles, there are so many ways to share your perspective.
Today, we're taking the power and magic of the Snap Camera — the spontaneity, the joy, and the freedom — to new heights. A new camera to match the limitless potential of your imagination. Meet Pixy. The world's friendliest flying camera.'

Pixy has four preset flight paths, and can float, orbit and follow you with a tap of a button. Once you're happy you've snapped enough footage, you can simply place your hand out, and Pixy will land in your palm.

The flying camera automatically syncs up with your Snapchat, transferring the footage into your Memories. from there, users can use Snapchat's editing tools just as they would with footage snapped on their phone, before sharing their creations to Chat, Stories, Spotlight of any other platform.

Unfortunately for Brits, Pixy is only available to buy in the US and France, where it is now on sale for $229.99.
It remains unclear when, or if, it will launch in the UK. we can't wait to see what you create on your next flight,' Mr Spiegel added.
Pixy is Snap's second piece of hardware, with the first being its range of smart glasses, called Spectacles.



MIT engineers develop a flexible, paper-thin loudspeaker

The flexible, thin-film device has the potential to make any surface into a low-power, high-quality audio source.

MIT engineers have developed a paper-thin loudspeaker that can turn any surface into an active audio source.

This thin-film loudspeaker produces sound with minimal distortion while using just a fraction of the energy required by a traditional loudspeaker. The hand-sized loudspeaker the team demonstrated, which weighs about as much as a dime, can generate high-quality sound no matter what surface the film is bonded to.

To achieve these remarkable properties, the researchers pioneered a deceptively simple fabrication technology that involves only three basic steps and can be scaled up to manufacture ultrathin loudspeakers large enough to cover the inside of an automobile or wallpaper a room.

Used this way, the thin-film loudspeaker could provide active noise cancellation in clamorous environments, such as an airplane cockpit, by generating sound of the same amplitude but opposite phase; the two sounds cancel each other out. The flexible device could also be used for immersive entertainment, perhaps by providing three-dimensional audio in a theatre or theme park ride. And because it is lightweight and requires such a small amount of power to operate, the device is well-suited for applications on smart devices where battery life is limited.

“It feels remarkable to take what looks like a slender sheet of paper, attach two clips to it, plug it into the headphone port of your computer, and start hearing sounds emanating from it. It can be used anywhere. One just needs a smidgeon of electrical power to run it,” says Vladimir Bulovic, the Fariborz Maseeh Chair in Emerging Technology, leader of the Organic and Nanostructured Electronics Laboratory (ONE Lab), director of MIT. Nano, and senior author of the paper.

Bulovic wrote the paper with lead author Jinchi Han, a ONE Lab postdoc, and co-senior author Jeffrey Lang, the Vitesse Professor of Electrical Engineering. The research is published today (April 26, 2022) in *IEEE Transactions of Industrial Electronics*.

A new approach

A typical loudspeaker found in headphones or an audio system uses electric current inputs that pass through a coil of wire that generates a magnetic field, which moves a speaker membrane, that moves the air above it, that makes the sound we hear. By contrast, the new loudspeaker simplifies the speaker design by using a thin film of a shaped piezoelectric material that moves when voltage is applied over it, which moves the air above it and generates sound.

Most thin-film loudspeakers are designed to be freestanding because the film must bend freely to produce sound. Mounting these loudspeakers onto a surface would impede the vibration and hamper their ability to generate sound.

To overcome this problem, the MIT team rethought the design of a thin-film loudspeaker. Rather than having the entire material vibrate, their design relies on tiny domes on a thin layer of piezoelectric material which

each vibrate individually. These domes, each only a few hair-widths across, are surrounded by spacer layers on the top and bottom of the film that protect them from the mounting surface while still enabling them to vibrate freely. The same spacer layers protect the domes from abrasion and impact during day-to-day handling, enhancing the loudspeaker's durability.

To build the loudspeaker, the researchers used a laser to cut tiny holes into a thin sheet of PET, which is a type of lightweight plastic. They laminated the underside of that perforated PET layer with a very thin film (as thin as 8 microns) of piezoelectric material, called PVDF. Then they applied vacuum above the bonded sheets and a heat source, at 80 degrees Celsius, underneath them.

Because the PVDF layer is so thin, the pressure difference created by the vacuum and heat source caused it to bulge. The PVDF can't force its way through the PET layer, so tiny domes protrude in areas where they aren't blocked by PET. These protrusions self-align with the holes in the PET layer. The researchers then laminate the other side of the PVDF with another PET layer to act as a spacer between the domes and the bonding surface.

"This is a very simple, straightforward process. It would allow us to produce these loudspeakers in a high-throughput fashion if we integrate it with a roll-to-roll process in the future. That means it could be fabricated in large amounts, like wallpaper to cover walls, cars, or aircraft interiors," Han says.

High quality, low power

The domes are 15 microns in height, about one-sixth the thickness of a human hair, and they only move up and down about half a micron when they vibrate. Each dome is a single sound-generation unit, so it takes thousands of these tiny domes vibrating together to produce audible sound.

An added benefit of the team's simple fabrication process is its tunability — the researchers can change the size of the holes in the PET to control the size of the domes. Domes with a larger radius displace more air and produce more sound, but larger domes also have lower resonance frequency. Resonance frequency is the frequency at which the device operates most efficiently, and lower resonance frequency leads to audio distortion.

Once the researchers perfected the fabrication technique, they tested several different dome sizes and piezoelectric layer thicknesses to arrive at an optimal combination.

They tested their thin-film loudspeaker by mounting it to a wall 30 centimeters from a microphone to measure the sound pressure level, recorded in decibels. When 25 volts of electricity were passed through the device at 1 kilohertz (a rate of 1,000 cycles per second), the speaker produced high-quality sound at conversational levels of 66 decibels. At 10 kilohertz, the sound pressure level increased to 86 decibels, about the same volume level as city traffic.

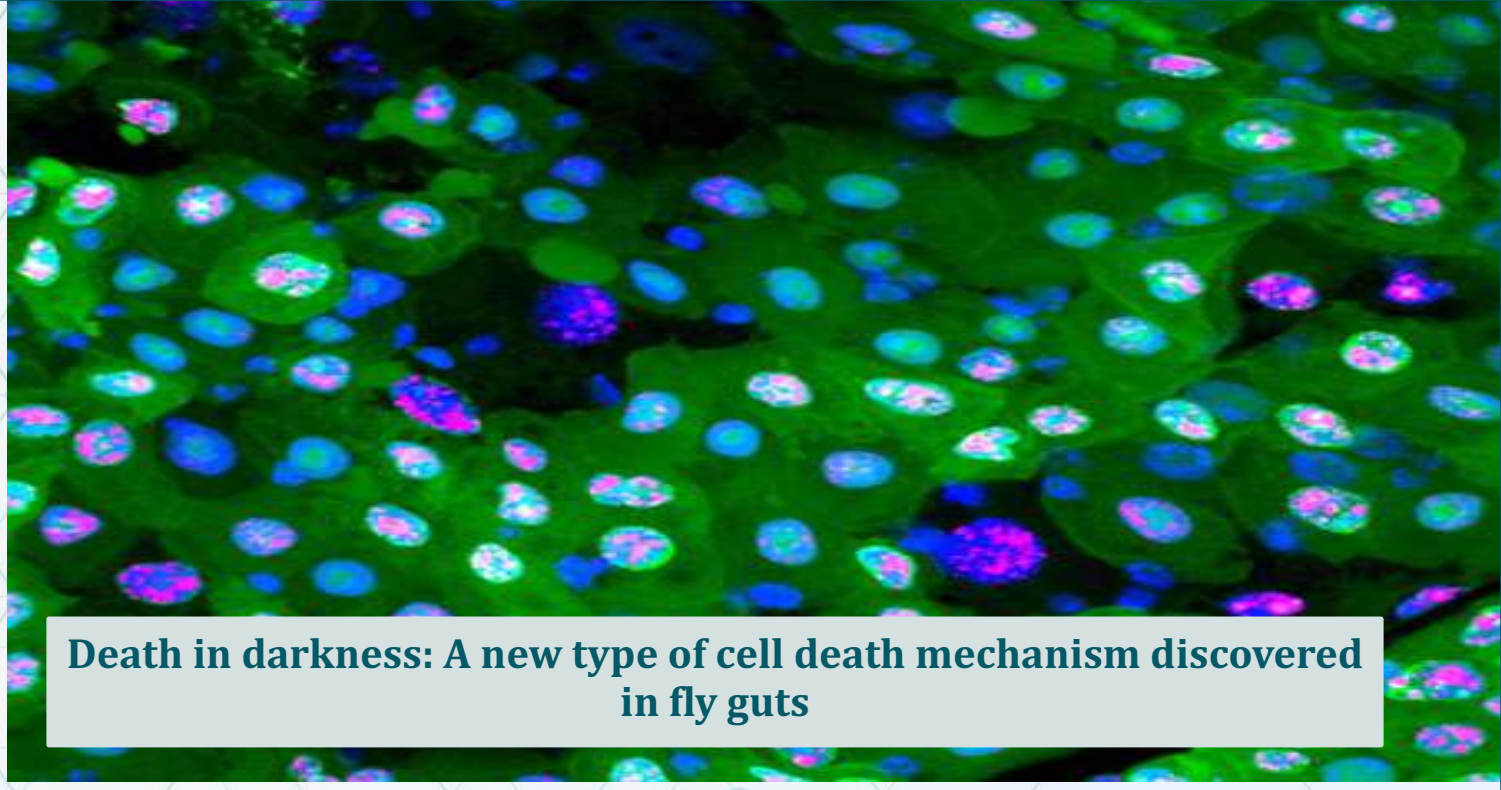
The energy-efficient device only requires about 100 milliwatts of power per square meter of speaker area. By contrast, an average home speaker might consume more than 1 watt of power to generate similar sound pressure at a comparable distance.

Because the tiny domes are vibrating, rather than the entire film, the loudspeaker has a high enough resonance frequency that it can be used effectively for ultrasound applications, like imaging, Han explains. Ultrasound imaging uses very high frequency sound waves to produce images, and higher frequencies yield better image resolution.

The device could also use ultrasound to detect where a human is standing in a room, just like bats do using echolocation, and then shape the sound waves to follow the person as they move, Bulovic says. If the vibrating domes of the thin film are covered with a reflective surface, they could be used to create patterns of light for future display technologies. If immersed in a liquid, the vibrating membranes could provide a novel method of stirring chemicals, enabling chemical processing techniques that could use less energy than large batch processing methods.

"We have the ability to precisely generate mechanical motion of air by activating a physical surface that is scalable. The options of how to use this technology are limitless," Bulovic says.

"I think this is a very creative approach to making this class of ultra-thin speakers," says Ioannis (John) Kymissis, Kenneth Brayer Professor of Electrical Engineering and Chair of the Department of Electrical Engineering at Columbia University, who was not involved with this research. "The strategy of doming the film stack using photolithographically patterned templates is quite unique and likely to lead to a range of new applications in speakers and microphones."



Death in darkness: A new type of cell death mechanism discovered in fly guts

Researchers have discovered a previously unknown type of cell death that takes place in the guts of the common fruit fly. The researchers believe the new process, dubbed "erebosis," plays a function in gut metabolism. The findings necessitate a rethinking of the conventional concept of cell death, and at the same time, overturn the previously established theory of tissue homeostasis in the gut. The work was published in the scientific journal *PLOS Biology* on April 25, 2022, and was headed by Sa Kan Yoo at the RIKEN Center for Biosystems Dynamics Research (BDR).

Like the skin, cells that make up the intestines are constantly dying and being replaced by new cells. This process, known as turnover, helps maintain the balance, or homeostasis, between tissue growth and tissue renewal. The conventional theory for turnover in the intestines is that aging or damaged cells die through a mechanism known as apoptosis. Apoptosis, often known as "planned cell death," is one of three kinds of cell death that are currently recognized. This theory is called into doubt by the new research study, which provides evidence for a second type of programmed cell death that may be exclusive to the intestines.

As is often the case, this discovery occurred by accident. The researchers were studying a fruit fly version of ANCE, an enzyme that helps lower blood pressure. They noticed that *Ance* expression in the fly gut was patchy, and that the cells that contained it had strange characteristics. "We found that Ance labels some weird cells in the fruit fly gut," says Yoo. "But it took a long time for us to figure out that these weird cells were actually dying." They found that the strange cells were dark, lacking nuclear membranes, mitochondria, and cytoskeletons, and sometimes even DNA and other cellular items that are needed for cells to stay alive.

The process was so gradual and unlike the more sudden and explosive cell death seen in apoptosis, that they realized it might be something new. Because the Ance-positive cells were often near where new cells are born in the gut, they theorized that the new type of cell death is related to turnover in the intestines. They tentatively named the process erebosis, based on the Greek '*erebos*' meaning 'darkness', because the dying cells looked so dark under the microscope.

To prove erebosis is a new type of cell death, the researchers conducted several tests. First, experimentally stopping apoptosis did not prevent gut homeostasis. This meant that cell turnover in the gut, including cell death, can proceed without apoptosis. Second, the dying cells did not show any of the molecular markers for apoptosis or the other two types of known cell death. Cells in late-stage erebosis did show a general marker for cell death related to degraded DNA.

Detailed examination of the cells in which erebosis was occurring revealed that they were located near clusters of gut stem cells. This is good evidence that erebotic cells are replaced by newly differentiated gut cells during turnover. Ironically, the enzyme that led to this discovery does not seem to be directly involved in the process, as knocking down or overexpressing Ance did not affect turnover or erebosis. Therefore, the next step is to work out the detailed molecular events that allow erebosis and cell turnover in the fly gut.

"I feel our results have the potential to be a seminal finding. Personally, this work is the most ground breaking research I have ever done in my life." says Yoo, "We are keenly interested in whether erbosis exists in the human gut as well as in fruit flies."

Researchers say it's never been seen before: A "mysterious, worm-like" aurora that stretches halfway round Mars.

(Image credit: Emirates Mars Mission)

Mars probe discovers 'shocking' new aurora

At first glance, it looks just like our own northern lights on Earth. But this aurora is over 55 million kilometres (40 million miles) away on Mars. And the researchers who spotted it say it is something quite extraordinary — even "shocking."

The aurora was photographed by the Emirates Mars Mission (EMM) probe, Hope.

Soon after Hope entered its orbit of Mars, the probe started imaging the planet's auroras. The researchers decided to focus more closely on the planet's so-called discrete auroras than originally planned.

"We knew we had unveiled [a] potential to make observations never before possible on this scale," said EMM Science Lead Hessa Al Matroushi in a statement.

Now, about a year later, the researchers say they have discovered a "huge, worm-like aurora that extends halfway around the Red planet" — one that has never been seen before.

They are calling it a "sinuous discrete aurora."

Auroras tell us about Mars' atmosphere

One of Hope's main objectives has always been to gather data on Mars' atmosphere. And the images of the auroras on Mars are shedding new light on the atmosphere's interactions with the planet's magnetic fields and solar wind.

The researchers say they want to provide data that will help the international science community create a global weather map for Mars, understand the planet's weather cycles and track the movement of hydrogen and oxygen between the different layers of the atmosphere.

Al Matroushi said they can scan almost the entire globe, capturing "synoptic snapshots" — images that provide a full overview of the planet — which will enable the researchers to investigate those atmospheric phenomena.

"We are seeing discrete auroral effects on a massive scale and in ways we never anticipated," said the scientist.

Other auroras on Mars

Scientists have previously detected three types of auroras on Mars.

First, there are diffuse auroras, which are produced by intense solar storms.

Second, there are the discrete auroras, which Hope has been investigating since the start of its mission. Discrete auroras are produced by magnetized minerals embedded in the planet's crust.

Diffuse and discreet auroras tend to be observed on Mars' nightside. That is the side of a planet that faces away from its star, and in Mars' case, that is Earth's sun.

Then there are proton auroras, which are observed on Mars' dayside (the side facing the sun).

Proton auroras appear to be a product of interactions between Mars' solar wind and hydrogen in the planet's exosphere — the outermost layer of a planet's atmosphere.

'Shocking:' Sinuous discrete aurora

And now we have this fourth type of aurora on Mars — the sinuous discrete aurora.

The researchers say sinuous discrete auroras consist of "long worm-like streaks of energized electron emissions in the upper atmosphere." And they extend many thousands of kilometres from the dayside into the nightside of Mars.

Tech in depth: understanding GaN chargers and their advantages

When looking for a new phone, the specifications are a top priority for most customers. However, there's one aspect of phones that is perhaps not considered so much. That's the charger. No, I don't mean the charging speed of your phone, but the actual charging brick. A new wave of chargers is set to hit the mainstream market soon called GaN chargers, which stands for Gallium Nitride chargers. These are smaller, more efficient and while they're already being used with many devices, they could soon be the future of all chargers. Here's all you need to know about GaN chargers.

What is Gallium Nitride?

Gallium Nitride is a material that is considered a better alternative to silicon, which is usually used to transfer power to your device in most chargers. Gallium Nitride is much better at conducting high voltage over longer times compared to silicon. It also allows electrical currents to travel faster through it.
This makes Gallium Nitride a more efficient solution to materials used in chargers, while being a faster solution as well. Thanks to the higher rate of conductivity, Gallium Nitride needs lesser energy than silicone to generate the same output. Less energy also translates to lower heat.

With lower heat, Gallium Nitride structures can be stacked closer to each other than other materials, which also means the overall structure (the charger) is smaller in size.

GaN Chargers

GaN chargers are more compact and better at charging your devices. These can charge supported laptops and smartphones not just more efficiently but faster as well. The smaller size allows for more use cases. For instance, some companies make GaN charger which are regular sized but offer things like multiple output ports, or support for various kinds of electrical sockets.

In theory, Gallium Nitride chargers also help you get a lower electricity bill, although for devices like smartphones and chargers, this difference will be too small to notice for many. You can buy Gallium Nitride chargers from third-party brands, or even check what charger you get with your phone or laptop. If it is a newer, premium gadget, chances are the bundled charger itself is a GaN unit.

So, why isn't every charger a GaN charger?

GaN is not a common piece of technology just yet, and one factor here is the cost. GaN semiconductors generally cost more than silicon semiconductors. This is one of the main reasons all chargers are not using GaN yet. When the technology becomes more widely used, which could be the case in the near future, given the benefits, GaN chargers could become much cheaper to mass produce due to companies investing in the initial manufacturing costs.
Moreover, just like chargers today are little computers with a circuit in their own right, computers can also be theoretically powered by Gallium Nitride semiconductors. Although this possibility is still far away.

The Elusive Unruh Effect: physicists embark on a hunt for a long-sought quantum glow

A new approach could make it possible detect the elusive Unruh effect in hours, rather than billions of years.

For “Star Wars” fans, the streaking stars seen from the cockpit of the Millennium Falcon as it jumps to hyperspace is a canonical image. But what would a pilot actually see if she could accelerate in an instant through the vacuum of space? She would most certainly see a warm glow, according to a prediction known as the Unruh effect.Since the 1970s when it was first proposed, the Unruh effect has eluded detection, owing to the fact that the probability of seeing the effect is infinitesimally small, requiring either incredible accelerations or vast periods of observation time.

However, researchers at MIT and the University of Waterloo believe they have discovered a mechanism to dramatically boost the likelihood of observing the Unruh effect, which they describe in a study published on (April 26, 2022) in *Physical Review Letters.*

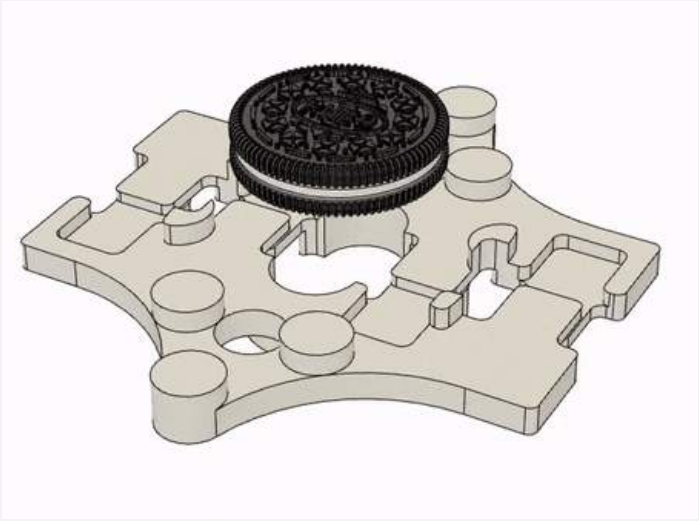
Rather than observing the effect spontaneously, as previous researchers have attempted in the past, the team proposes stimulating the phenomenon, in a very particular way that amplifies the Unruh effect while suppressing other competing effects. The researchers compare their concept to casting an invisibility cloak over other conventional phenomena, which should then reveal the much less obvious Unruh effect.

If it can be realized in a practical experiment, this new stimulated approach, with an added layer of invisibility (or “acceleration-induced transparency,” as described in the paper) could vastly increase the probability of observing the Unruh effect. Instead of waiting longer than the age of the universe for an accelerating particle to produce a warm glow as the Unruh effect predicts, the team's approach would shave that wait time down to a few hours.

“Now at least we know there is a chance in our lifetimes where we might actually see this effect,” says study co-author Vivishek Sudhir, assistant professor of mechanical engineering at MIT, who is designing an experiment to catch the effect based on the group's theory. “It's a hard experiment, and there's no guarantee that we'd be able to do it, but this idea is our nearest hope.”

The study's co-authors also include Barbara Šoda and Achim Kempf of the University of Waterloo.

Introducing the MIT oreometer – Mechanical Engineers put an Oreo's cream filling through a battery of tests



Mechanical engineers put an Oreo's cream filling through a battery of tests to understand what happens when two wafers are twisted apart.

When you twist an Oreo cookie open to get to the creamy center, you're mimicking a basic rheological test. (Rheology is the study of how a non-Newtonian material flows when twisted, pressed, or otherwise strained.) MIT engineers have now subjected the sandwich cookie to rigorous materials testing in order to answer a vexing question: why does the cookie's cream stick to only one wafer when twisted apart?
"There's the fascinating problem of trying to get the cream to distribute evenly between the two wafers, which turns out to be really hard," says Max Fan, an undergraduate in MIT's Department of Mechanical Engineering.

Why does the cookie's cream stick to just one wafer when twisted apart? MIT engineers pursue the answer.
In search of an answer, the team exposed cookies to normal rheology experiments in the lab and discovered that, regardless of flavor or amount of stuffing, the cream in the center of an Oreo almost always adheres to one wafer when twisted open. Only in older boxes of cookies does the cream sometimes divide more equally between the two wafers.

The researchers also measured the torque required to twist open an Oreo, and found it to be similar to the torque required to turn a doorknob and about 1/10th what's needed to twist open a bottlecap. The cream's failure stress — i.e. the force per area required to get the cream to flow, or deform — is twice that of cream cheese and peanut butter, and about the same magnitude as mozzarella cheese. Judging from the cream's response to stress, the team classifies its texture as "mushy," rather than brittle, tough, or rubbery.

When you twist open an Oreo cookie to get to the creamy center, you're mimicking a standard test in rheology — the study of how a non-Newtonian material flows when twisted, pressed, or otherwise stressed.
So, why does the cookie's cream glom to one side rather than splitting evenly between both? The manufacturing process may be to blame.

"Videos of the manufacturing process show that they put the first wafer down, then dispense a ball of cream onto that wafer before putting the second wafer on top," says Crystal Owens, an MIT mechanical engineering PhD candidate who studies the properties of complex fluids. "Apparently that little time delay may make the cream stick better to the first wafer."

Biochemists identify how genome organization influences cell fate

University of California Riverside-led study identifies how blood stem cells maintain their fate.

Understanding the molecular mechanisms that specify and maintain the identities of the human body's more than 200 cell types is perhaps one of the most fundamental problems in molecular and cellular biology, with major implications for human disease management. Stem cells, which exist in every tissue of the body, play a critical role in the cell fate decision process.

When stem cells divide, they have the extraordinary potential to self-renew — that is, to replicate themselves — or to develop into specified lineages. The study of a research team led by biochemists at the University of California, Riverside has improved our understanding of how a distinct lineage identity is maintained every time a stem cell divides.

The research study led by Sihem Cheloufi and Jernej Murn, both assistant professors in the Department of Biochemistry, shows how a protein complex, called chromatin assembly factor-1, or CAF-1, controls genome organization to maintain lineage fidelity. The report will be published on (April 29, 2022) in the journal *Nature Communications.*

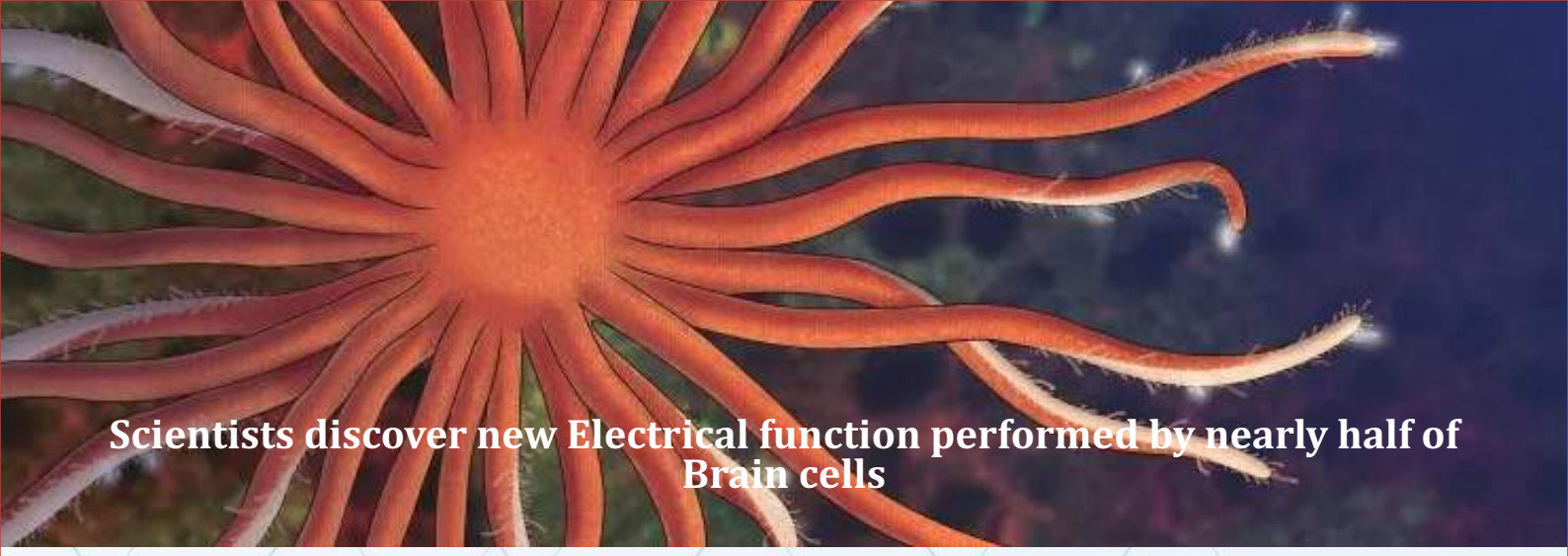
Each time a cell divides, it has to create a replica of its genome — not only its DNA sequence but also how the DNA is packaged with proteins into chromatin. Chromatin is organized into genomic sites that are either open and easily accessible or more densely packed and less accessible (or closed).

“Identities of different cells rely heavily on the genome sites that are more open because only genes located in those regions can potentially become expressed and turned into proteins,” Cheloufi explained.

She added that to maintain cell identity during cell division, the locations of open and closed chromatin, or “chromatin organization,” must be faithfully passed onto the new replica of the genome, a task largely entrusted to CAF-1.

“To help CAF-1 secure correct chromatin organization during cell division, a host of transcription factors are attracted to open regions in a DNA sequence-specific manner to serve as bookmarks and recruit transcription machinery to correct lineage-specific genes, ensuring their expression,” she said. “We wondered about the extent to which CAF-1 is required to maintain cell-specific chromatin organization during cell division.”The authors took as a study paradigm immature blood cells that can either self-renew or turn into neutrophils, which are non-dividing cells that present our body's first line of defense against pathogens. Intriguingly, they found CAF-1 to be essential not only for maintaining the self-renewal of these immature blood cells, but for preserving their lineage identity. Even a moderate reduction of CAF-1 levels caused the cells to forget their identity and adopt a mixed lineage stage.

“Neutrophil stem cells missing CAF-1 become more plastic, co-expressing genes from different lineages, including those of red blood cells and platelets,” Cheloufi said. “This is very intriguing from a developmental biology perspective.”



Scientists discover new Electrical function performed by nearly half of Brain cells

Surprising research findings in mice could lead to new insights and treatments for a wide range of brain and neurological diseases, from epilepsy to Alzheimer's.

Researchers at Tufts University School of Medicine have discovered a previously unknown function performed by astrocytes, a type of cell that comprises nearly half of all cells in the brain.

According to the researchers, the discovery in mice of a novel function by cells known as astrocytes opens up a whole new avenue for neuroscience study that could lead to treatments for a variety of conditions ranging from epilepsy to Alzheimer's to traumatic brain injury.

It all boils down to how astrocytes interact with neurons, which are fundamental cells of the brain and nervous system that receive input from the outside world. Through a complex set of electrical and chemical signaling, neurons transmit information between different areas of the brain and between the brain and the rest of the nervous system.

Until now, scientists believed astrocytes were important, but lesser cast members in this activity. Astrocytes guide the growth of axons, the long, slender projection of a neuron that conducts electrical impulses. They also control neurotransmitters, chemicals that enable the transfer of electrical signals throughout the brain and nervous system. In addition, astrocytes build the blood-brain barrier and react to injury.

But they did not seem to be electrically active like the all-important neurons—until now.

“The electrical activity of astrocytes changes how neurons function,” says Chris Dulla, associate professor of neuroscience at the School of Medicine and Graduate School of Biomedical Sciences, and corresponding author on a paper published on (April 28, 2022) by *Nature Neuroscience*. “We have discovered a new way that two of the most important cells in the brain talk to each other. Because there is so much unknown about how the brain works, discovering new fundamental processes that control brain function is key to developing novel treatments for neurological diseases.”

In addition to Dulla and lead author Moritz Armbruster, the study's other authors include Saptarnab Naskar, Mary Sommer, Elliot Kim, and Philip G. Haydon from Tufts University School of Medicine; Jacqueline P. Garcia from the Cell, Molecular and Developmental Biology program at Tufts Graduate School of Biomedical Sciences; and researchers from other institutions.

To make the discovery, the team used brand new technology to devise a technique that enables them to see and study the electrical properties of brain cell interactions, which could not be observed previously.

“With these new tools, we've essentially uncovered completely novel aspects of the biology,” says Armbruster, research assistant professor of neuroscience at the School of Medicine. “As better tools come along—for example, new fluorescent sensors are being developed constantly—we'll get a better understanding of things we didn't even think about before.”

“The new technology images electrical activity with light,” Dulla explains. “Neurons are very electrically active, and the new technology allows us to see that astrocytes are electrically active, as well.”

Dulla describes astrocytes as “making sure everything is copacetic in the brain, and if something goes wrong, if there's an injury or viral infection, they detect it, try to respond, and then try to protect the brain from insult. What we want to do next is determine how astrocytes change when these insults happen.”

Neuron-to-neuron communication occurs through the release of packets of chemicals called neurotransmitters. Scientists knew that astrocytes control neurotransmitters, helping to make sure that neurons stay healthy and active. But the new study reveals that neurons also release potassium ions, which change the electrical activity of the astrocyte and how it controls the neurotransmitters.