Ode to E Pluribus Unum for Sunday August 6 2023

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One for the Sistine Chapel Maybe?

Our astrophoto is a dramatic scene of emission nebulas NGC 6188 and NGC 6188 in the constellation Ara captured by astrophotographer Vikas Chander.

"Painted on the canvas of the night, are two dragons fighting each other on a portion of the sky known as the Altar, or the constellation of Ara". Chander told Space.com in an email.

The massive young stars embedded in the stellar scene formed only a few million years ago. Their stellar winds and intense ultraviolet radiation sculpt the "dragons" we see fighting in the sky and cause the nebulas to glow according to NASA.

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Entropy: The Most Misunderstood Concept in Physics

https://youtu.be/DxL2HoqLbyA

Thank God the earth is not a closed system

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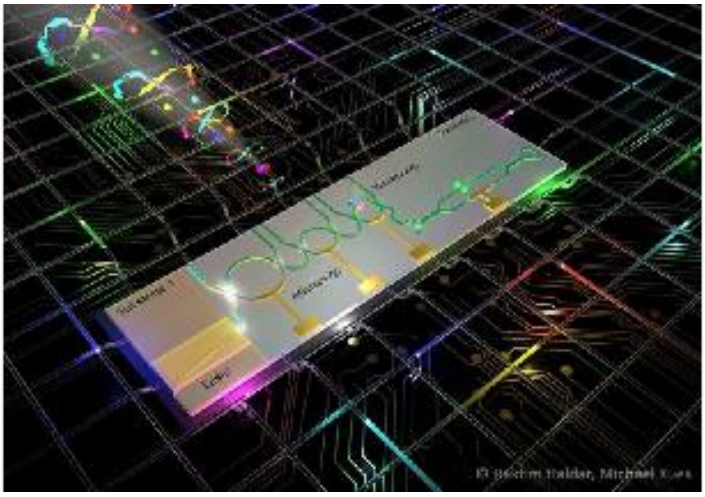
Bringing Scalability to the Quantum Cloud

Quantum light source goes fully on-chip



Artistic illustration of the chip-integrated quantum light source for the generation of entangled photons.
Credit: Raktim Haldar/Michael Kues

An international team of researchers from Leibniz University Hannover (Germany), the University of Twente (Netherlands), and the start-up company QuiX Quantum has presented an entangled quantum light source fully integrated for the first time on a chip. The results of the study were published in the journal Nature Photonics.

"Our breakthrough allowed us to shrink the source size by a factor of more than 1,000, allowing reproducibility, stability over a longer time, scaling, and potentially mass-production. All these characteristics are required for real-world applications such as quantum processors," says Prof. Dr. Michael Kues, head of the Institute of Photonics, and board member of the Cluster of Excellence PhoenixD at Leibniz University Hannover.

Quantum bits (qubits) are the basic building blocks of quantum computers and the quantum internet. Quantum light sources generate light quanta (photons) that can be used as quantum bits. On-chip photonics has become a leading platform for processing optical quantum states as it is compact, robust, and allows to accommodate and arrange many elements on a single chip. Here, light is directed on the chip through extremely compact structures, which are used to build photonic quantum computing systems. These are already accessible today through the cloud. Scalably implemented, they could solve tasks that are inaccessible to conventional computers due to their limited computing capacities. This superiority is referred to as quantum advantage.

The whole quantum light source fits on a chip smaller than a one-euro coin. The researchers reduced the size of the light source by a factor of more than 1,000 by using a novel "hybrid technology" that combines a laser made of indium phosphide and a filter made of silicon nitride on a single chip. The new light source is efficient and stable and can find applications to drive quantum computers or the quantum internet. Credit: Institute of Photonics/LUH

"Until now, quantum light sources required external, off-chip and bulky laser systems, which limited their use in the field. However, we overcome these challenges through a novel chip design and by exploiting different integrated platforms," says Hatam Mahmudlu, a Ph.D. student in Kues's team. Their new development, an electrically-excited, laser-integrated photonic quantum light source, fits entirely on a chip and can emit frequency-entangled qubit states.

"Qubits are very susceptible to noise. The chip must be driven by the laser field, completely free from noise, requiring an on-chip filter. Previously, it was a major challenge to integrate laser, filter, and a cavity on the same chip as there was no unique material that was efficient to build these different components," says Dr. Raktim Haldar, a Humboldt fellow in Kues's group.

The key was the "hybrid technology" that combines the laser made of indium phosphide, a filter, and a cavity made of silicon nitride and brings them together into a single chip. On the chip, in a spontaneous nonlinear process, two photons are created from a laser field. Each photon spans a range of colors simultaneously, which is called "superposition," and the colors of both photons are correlated, i.e., the photons are entangled and can store quantum information. "We achieve remarkable efficiencies and

state qualities required for application in quantum computers or the quantum internet," says Kues.

"Now we can integrate the laser with other components on a chip so that the whole quantum source is smaller than a one-euro coin. Our tiny device could be considered a step towards quantum advantage on a chip with photons. Unlike Google, which currently uses super-cold qubits in cryogenic systems, the quantum advantage could be achieved with such photonic systems on a chip even at room temperature," says Haldar.

The scientists also expect their discovery to help lower the production costs of applications. "We can imagine that our quantum light source will soon be a fundamental component of programmable photonic quantum processors," says Kues.

Prof. Dr. Michael Kues is head of the Institute of Photonics and a board member of the Cluster of Excellence PhoenixD: Photonics, Optics, and Engineering—Innovation across Disciplines at Leibniz University Hannover, Germany.

by Leibniz University Hannover

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Wings Over Camarillo, August 19 & 20.

I'll be there again in the Veteran's Lounge area

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JPL's Snake-Like EELS Slithers into New Robotics Terrain

EELS is tested in JPL's sandy terrain yard
NASA/CalTecj

EELS is tested in the sandy terrain of JPL's Mars Yard in April. Engineers repeatedly test the snake robot across a variety of terrain, including sand, snow, and ice. Credit: NASA/JPL-Caltech

https://bit.ly/44I7Q6O

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Original Illustrations from Dickens' Novels Are Available Online

Illustration from "A Tale of Two Cities"

The Charles Dickens Illustrated Gallery has archived all of the original images featured in Dickens' work throughout his creative career. Dr. Michael John Goodman, who is also the creator of the Victorian Illustrated Shakespeare Archive, had the idea to digitize the art from Dickens' novels during the COVID-19 lockdown.

https://bit.ly/3OmPClY

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Movie stars Dancing to…'I'm So Excited!'

https://youtu.be/xVuIVP6Pef8

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How Scientific Models Help and Deceive Us in Decision Making

Human insights Given the inherent limitation to scientific models of, say, climate change or the spread of viruses, it could make sense to get a wider range of people involved when turning the predictions from such models into public policy decisions.
(Courtesy: iStock/FotoMaximum)

We live in a society where scientific models surround us. They are used for everything from creating weather bulletins and making climate projections to providing economic forecasts and informing policies for public health. But despite being such useful tools, all scientific models have limitations. Because as any modeler knows, the output of a model is only as good as the data you put in.

What's more, uncertainties creep in at every corner of the modelling exercise. The results of a model depend on, for example, the values of the parameters, the boundary conditions, and the basic assumptions of the model itself. So how can we ensure scientific models are used responsibly when deciding matters of public policy?

https://bit.ly/3NsBJjL

Michela Massimi reviews *Escape from Model Land* by Erica Thompson

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NASA's Mars Sample Return Has a Colossal New Price Tag

"It is better to not do it than to torch the whole science community."

This illustration shows a concept for a proposed NASA Sample Retrieval Lander, about the size of an average two-car garage, that would carry a small rocket called the Mars Ascent Vehicle to the Martian surface.
NASA

https://bit.ly/44kvqWe

Wouldn't it be cheaper to develop and deploy small labs to work in tandem with rovers? Either that or turn the project over to Mr. Musk and his profit-oriented achievers.

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Northrop Grumman EGI-M for F-22 Raptor and E-2D Hawkeye

File photo on an F-22 Raptor (Air Force photo by Giancarlo Casem). In the boxes: pre-flight preparations aboard Northrop Grumman's testbed for its advanced airborne navigation system.

and file photo of the E-2D Advanced Hawkeye, one of the launch platforms of the EGI-M.
(Photo: Northrop Grumman)

The new embedded GPS/INS (EGI-M) system will allow operation in GPS-contested and GPS-denied environment.

https://theaviationist.com/2023/06/30/new-egi-m-tested/

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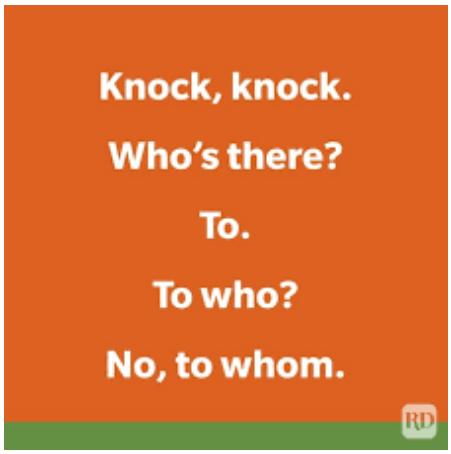

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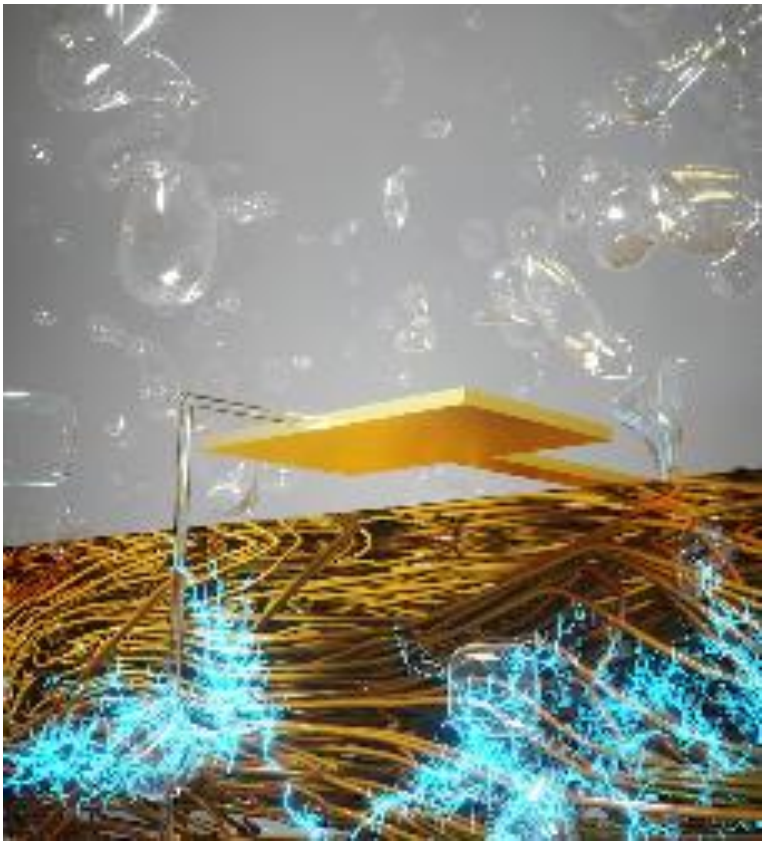
Scientists Can Make Energy from Air Using Nearly Any Material



Water droplets suspended in the air fall on the spaghetti-like nanoporous material, generating electricity that flows through the electrodes (yellow rectangle) to power whatever needs powering.
(Derek Lovley/Ella Maru Studio)

Nearly any material can be used to turn the energy in air humidity into electricity, scientists found in a discovery that could lead to continuously producing clean energy with little pollution.

The research, published in a paper in Advanced Materials, builds on 2020 work that first showed energy could be pulled from the moisture in the air using material harvested from bacteria. The new study shows nearly any material can be used, like wood or silicon, as long as it can be smashed into small particles and remade with microscopic pores. But there are many questions about how to scale the product.

"What we have invented, you can imagine it's like a small-scale, man-made cloud," said Jun Yao, a professor of engineering at the University of Massachusetts at Amherst and the senior author of the study. "This is really a very easily accessible, enormous source of continuous clean electricity. Imagine having clean electricity available wherever you go."

That could include a forest, while hiking on a mountain, in a desert, in a rural village or on the road.

The air-powered generator, known as an "Air-gen," would offer continuous clean electricity since it uses the energy from humidity, which is always present, rather than depending on the sun or wind. Unlike solar panels or wind turbines, which need specific environments to thrive, Air-gens could conceivably go anywhere, Yao said.

Less humidity, though, would mean less energy could be harvested, he added. Winters, with dryer air, would produce less energy than summers.

The device, the size of a fingernail and thinner than a single hair, is dotted with tiny holes known as nanopores. The holes have a diameter smaller than 100 nanometers, or less than a thousandth of the width of a strand of human hair.

The tiny holes allow the water in the air to pass through in a way that would create a charge imbalance in the upper and lower parts of the device, effectively creating a battery that runs continuously.

"We are opening up a wide door for harvesting clean electricity from thin air," Xiaomeng Liu, another author and a UMass engineering graduate student, said in a statement.

While one prototype only produces a small amount of energy — almost enough to power a dot of light on a big screen — because of its size, Yao said Air-gens can be stacked on top of each other, potentially with spaces of air in between. Storing the electricity is a separate issue, he added.

Yao estimated that roughly 1 billion Air-gens, stacked to be roughly the size of a refrigerator, could produce a kilowatt and partly power a home in ideal conditions. The team hopes to lower both the number of devices needed and the space they take up by making the tool more efficient. Doing that could be a challenge.

The scientists first must work out which material would be most efficient to use in different climates. Eventually, Yao said he hopes to develop a strategy to make the device bigger without blocking the humidity that can be captured. He also wants to figure out how to stack the devices on top of each other effectively and how to engineer the Air-gen so the same size device captures more energy.

It's not clear how long that will take.

"Once we optimize this, you can put it anywhere," Yao said.

It could be embedded in wall paint in a home, made at a larger scale in unused space in a city or littered throughout an office's hard-to-get-to spaces. And because it can use nearly any material, it could extract less from the environment than other renewable forms of energy.

"The entire earth is covered with a thick layer of humidity," Yao said. "It's an enormous source of clean energy. This is just the beginning in making use of that."

By Dan Rosenzweig-Ziff for The Washington Post

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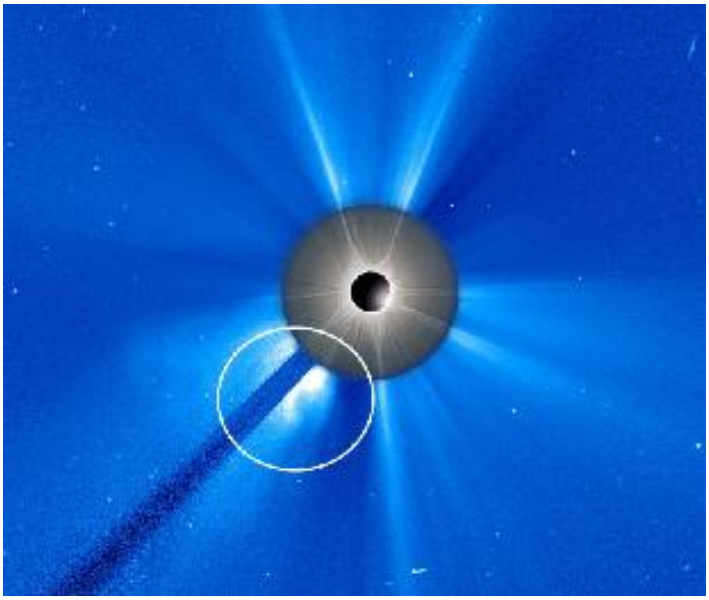
A Gargantuan Storm Blasts Out of the Sun During a Total Solar Eclipse

A stunning composite image of the sun during a recent 'hybrid eclipse' in Australia is further proof that solar activity is ramping up.



The solar storm in the photographers' image aligns perfectly with an explosion of particles seen in this coronagraph from the Solar and Heliospheric Observatory, taken at the same time.
(Image credit: Petr Horálek)

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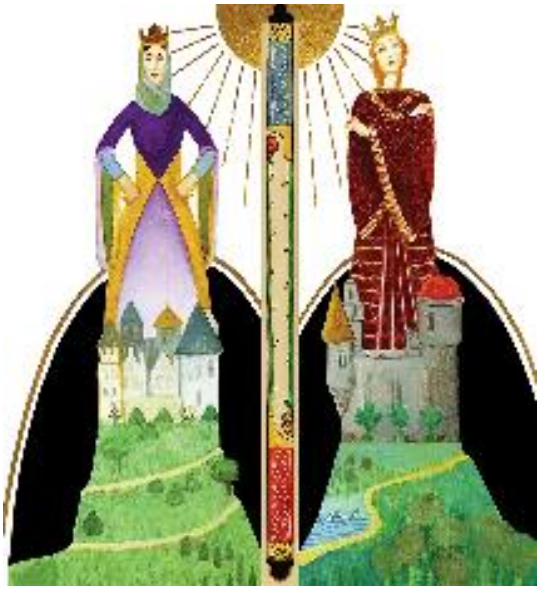
Medieval Queens Whose Murderous Reigns Were Forgotten



Over the centuries, Brunhild and Fredegund were dismissed and even parodied. But a new book shows how they outwitted their enemies like few in history.

https://bit.ly/3NFeDqi

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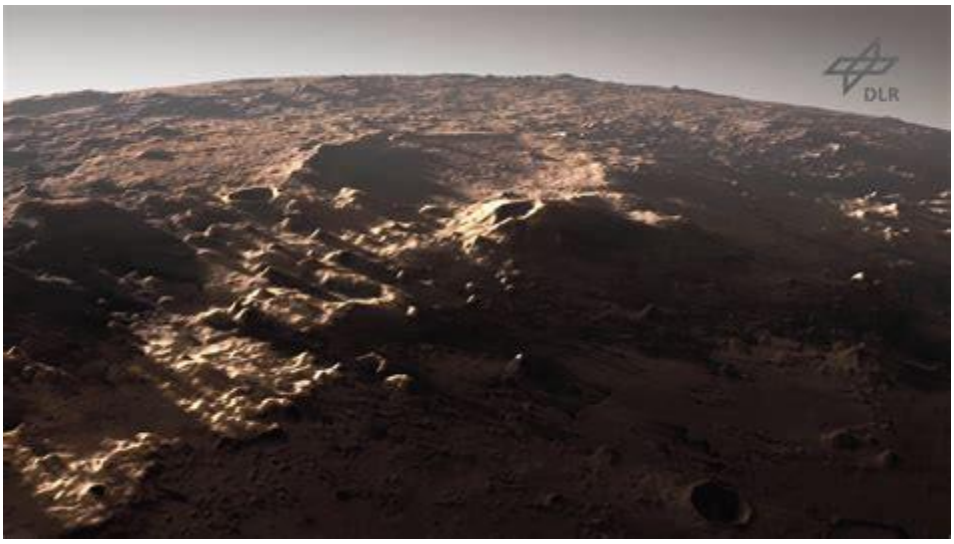
Jezero Crater Flyover



An animated flyover of the Martian surface explains why Mars' Jezero Crater, a 28-mile-wide ancient lake-delta system, is the best place for the Mars 2020 rover to find and collect promising samples for a possible future return to Earth. For more about the mission, please visit https://mars.nasa.gov/mars2020

https://www.youtube.com/watch?v=qnZ_sidmr4Y

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The Future of Human Vision

A psychologist and expert in how the brain 'sees' explains how advances in brain imaging and computing are unlocking the secrets of human vision.

https://bit.ly/3Q63bHi

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The Inner Life of the Cell Animation

Harvard University selected XVIVO to develop an animation that would take their cellular biology students on a journey through the microscopic world of a cell, illustrating mechanisms that allow a white blood cell to sense its surroundings and respond to an external stimulus.

https://youtu.be/wJyUtbn0O5Y

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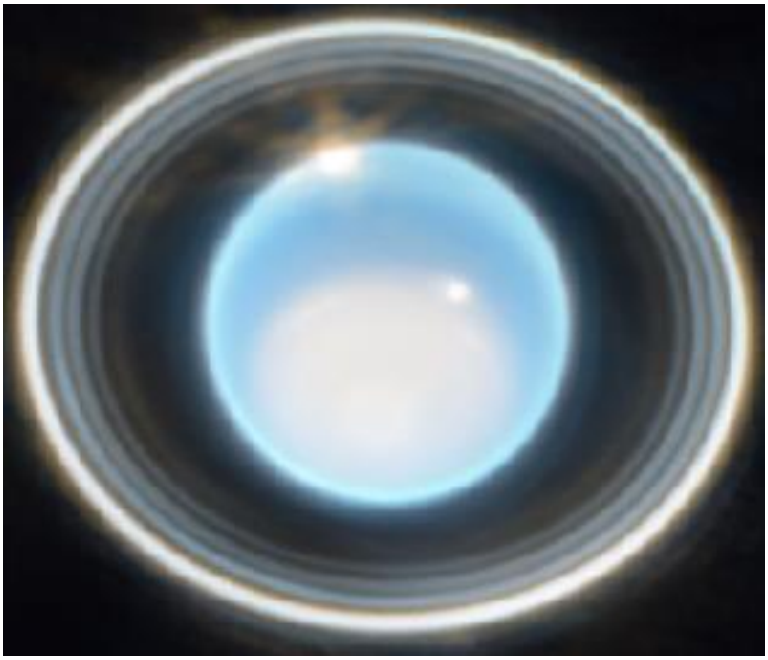
Saturn's Rings Steal the Show in New Images from Webb



Webb turned its gold-coated mirror toward Saturn this week.

https://bit.ly/4389M6L

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Why No Love for the B-21?

The $2 billion B-2 Spirit, which was state of the art is actually an interim bomber. Well, maybe not that exactly, but now we apparently need something better…and kinda quick.

https://bit.ly/3pWObAK

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What is Labster and How Can It Be Used for Teaching

Labster is a virtual laboratory testing space for schools and colleges.

https://bit.ly/3K4Oq3n

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1000 Drones for the Fourth…and a Question

Can you imagine what it would be like to figure out which of these are bad guys and which are there to confuse the issue?

https://youtu.be/zdOTV2RH9IY?t=1

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How About Five Cylinder Engine for Your Bicycle?

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AR Apps and Virtual Star Maps Help You Navigate the Night Sky

The best stargazing apps transform your smartphone into a map of the sky to help you identify objects and add to your knowledge of the cosmos.

https://bit.ly/3K74lya

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What's the Difference Between Tequila and Mezcal?

It's a great deal more than just "smokiness"

Agaves outside the ovens at the Jose Cuervo distillery in Tequila

https://bit.ly/44t2Anc

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The Economics of Cruise Ships

Major cruise lines rake in more booty than Blackbeard himself — in 2020, we estimated the average cruise ship made $291 in profit per passenger, per cruise.

They also have nifty tricks (see: tax exemptions) to pocket a substantial sum of their revenue. By registering ships elsewhere and flying foreign flags, the cruise industry's major players avoid millions in corporate taxes.

https://youtu.be/lUE5MD9I_ck?t=2

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My Other Dog's a Crow

https://youtu.be/iUIbg0skPdw

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Meeting Mammals

The Edges of Earth expedition is on a mission to share untold ocean stories from around the globe. Over the next 24 months, the team will travel to 50 of the most remote dive destinations in the world and Oceanographic will share their stories along the way. In Australia, the Edges of Earth team finds out more about conservation initiatives to protect endangered sea lions.

https://bit.ly/3XZgrPT

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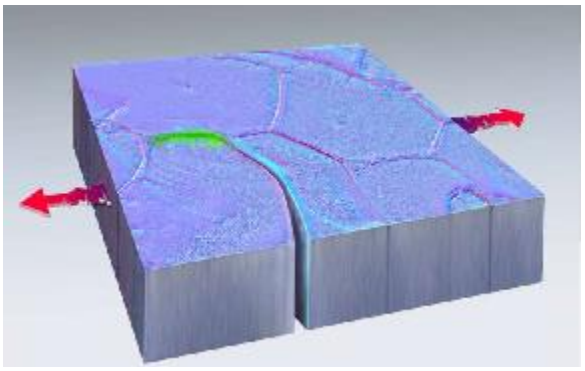
'Stunning' Discovery: Metals Can Heal Themselves



Green marks the spot where a fissure formed, then fused back together in this artistic rendering of nanoscale self-healing in metal, discovered at Sandia National Laboratories. Red arrows indicate the direction of the pulling force that unexpectedly triggered the phenomenon.
Credit: Dan Thompson, Sandia National Laboratories

Scientists for the first time have witnessed pieces of metal crack, then fuse back together without any human intervention, overturning fundamental scientific theories in the process. If the newly discovered phenomenon can be harnessed, it could usher in an engineering revolution—one in which self-healing engines, bridges and airplanes could reverse damage caused by wear and tear, making them safer and longer-lasting.

The research team from Sandia National Laboratories and Texas A&M University described their findings today in the journal Nature.

"This was absolutely stunning to watch first-hand," said Sandia materials scientist Brad Boyce.

"What we have confirmed is that metals have their own intrinsic, natural ability to heal themselves, at least in the case of fatigue damage at the nanoscale," Boyce said.

Fatigue damage is one way machines wear out and eventually break. Repeated stress or motion causes microscopic cracks to form. Over time, these cracks grow and spread until—snap! The whole device breaks, or in the scientific lingo, it fails.

The fissure Boyce and his team saw disappear was one of these tiny but consequential fractures—measured in nanometers.

"From solder joints in our electronic devices to our vehicle's engines to the bridges that we drive over, these structures often fail unpredictably due to cyclic loading that leads to crack initiation and eventual fracture," Boyce said. "When they do fail, we have to contend with replacement costs, lost time and, in some cases, even injuries or loss of life. The economic impact of these failures is measured in hundreds of billions of dollars every year for the U.S."

Although scientists have created some self-healing materials, mostly plastics, the notion of a self-healing metal has largely been the domain of science fiction.

"Cracks in metals were only ever expected to get bigger, not smaller. Even some of the basic equations we use to describe crack growth preclude the possibility of such healing processes," Boyce said.

Unexpected discovery confirmed by theory's originator

In 2013, Michael Demkowicz—then an assistant professor at the Massachusetts Institute of Technology's department of materials science and engineering, now a full professor at Texas A&M—began chipping away at conventional materials theory. He published a new theory, based on findings in computer simulations, that under certain conditions metal should be able to weld shut cracks formed by wear and tear.

The discovery that his theory was true came inadvertently at the Center for Integrated Nanotechnologies, a Department of Energy user facility jointly operated by Sandia and Los Alamos national laboratories.

"We certainly weren't looking for it," Boyce said.

Khalid Hattar, now an associate professor at the University of Tennessee, Knoxville, and Chris Barr, who now works for the Department of Energy's Office of Nuclear Energy, were running the experiment at Sandia when the discovery was made. They only meant to evaluate how cracks formed and spread through a nanoscale piece of platinum using a specialized electron microscope technique they had developed to repeatedly pull on the ends of the metal 200 times per second.

Surprisingly, about 40 minutes into the experiment, the damage reversed course. One end of the crack fused back together as if it was retracing its steps, leaving no trace of the former injury. Over time, the crack regrew along a different direction.

Hattar called it an "unprecedented insight."

Boyce, who was aware of the theory, shared his findings with Demkowicz.

"I was very glad to hear it, of course," Demkowicz said. The professor then recreated the experiment on a computer model, substantiating that the phenomenon witnessed at Sandia was the same one he had theorized years earlier.

Their work was supported by the Department of Energy's Office of Science, Basic Energy Sciences; the National Nuclear Security Administration and the National Science Foundation.

A lot remains unknown about the self-healing process, including whether it will become a practical tool in a manufacturing setting.

"The extent to which these findings are generalizable will likely become a subject of extensive research," Boyce said. "We show this happening in nanocrystalline metals in vacuum. But we don't know if this can also be induced in conventional metals in air."

Yet for all the unknowns, the discovery remains a leap forward at the frontier of materials science.

"My hope is that this finding will encourage materials researchers to consider that, under the right circumstances, materials can do things we never expected," Demkowicz said.

by Sandia National Laboratories

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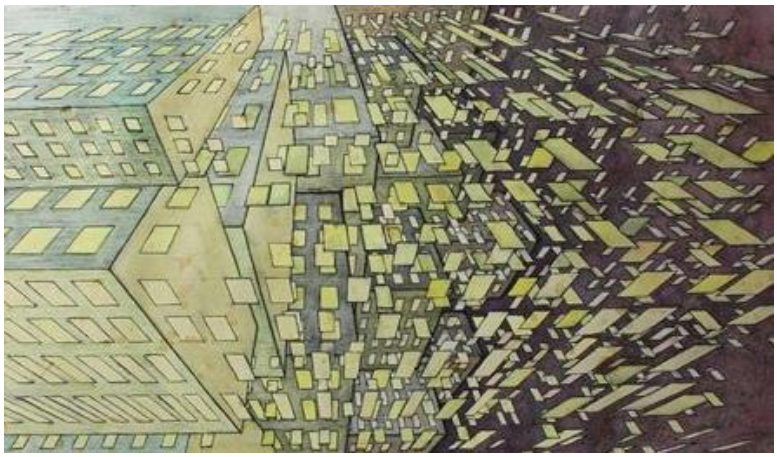
High-Tech Small-Scale KAPLA Tricks

https://youtu.be/Z9vx2ZKSggQ

Big Scale Tricks by the Loizeaux Group



https://www.youtube.com/watch?v=Pv06X_RsTE8

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The Restaurant of Mistaken Orders

An unusual Japanese pop-up restaurant that serves a lesson along with food.

https://www.youtube.com/watch?v=QvbSCLpwq6w

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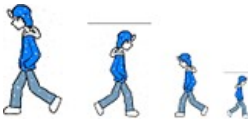
My Walking Thoughts



For Sunday August 6 2023

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