



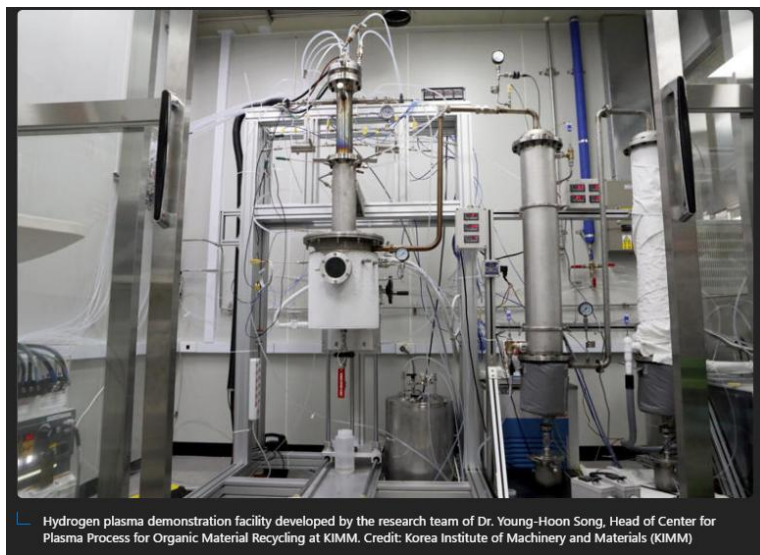
Show Notes 26 September 2025

Story 1: No sorting needed: Plasma torch shows promise for hassle-free plastic recycling

Source: TechXplore.com

Story by Science X staff

Link: <https://techxplore.com/news/2025-09-plasma-torch-hassle-free-plastic.html>



Hydrogen plasma demonstration facility developed by the research team of Dr. Young-Hoon Song, Head of Center for Plasma Process for Organic Material Recycling at KIMM. Credit: Korea Institute of Machinery and Materials (KIMM)

- Researchers at the Korea Institute of Machinery and Materials have developed the world's first plasma-based chemical recycling technology that can process mixed waste plastics without sorting or label removal.
- How it works:

- This process uses **hydrogen plasma**, a superheated, ionized gas, to break down mixed plastic waste into reusable chemicals like **ethylene** and **benzene**—key building blocks for new plastics.
 - **Side note:**
 - Ethylene is used to create polyethylene used in plastic bags, bottles, containers, and insulation.
 - Benzene is used for packaging, foam, utensils, and for electronics, lenses and adhesives.
 - **Process Temperature Range:** 1,832–3,632°F (1,000–2,000° Celsius)
 - **Process Reaction Time:** <0.01 seconds—faster than a blink
 - **Process Fuel Source:** 100% hydrogen, which suppresses carbon soot formation
 - The plasma torch exploits rapid energy transfer and bond dissociation kinetics to instantly convert polymers into simpler molecules. It's a clean, controlled reaction with minimal byproducts.
 - **Side note:** Bond dissociation kinetics refers to the rate and mechanism by which a chemical bond breaks, typically under thermal, photochemical, or catalytic conditions.
 - By controlling the reaction temperature and time, the researchers achieved selectivity levels of 70–90% and ethylene yields exceeding 70%. After purification, more than 99% of the output could be secured as high-purity raw materials for plastic manufacturing.
- Again, the big news is this method eliminates the need for **manual separation**, which is a major bottleneck in conventional [plastic] recycling.



Story 2: MIT spinoff achieves major milestone in pursuit of limitless energy beneath our feet: 'Could fundamentally change how we power our world'

Source: The Cool Down via MSN.com

Story by Craig Gerard

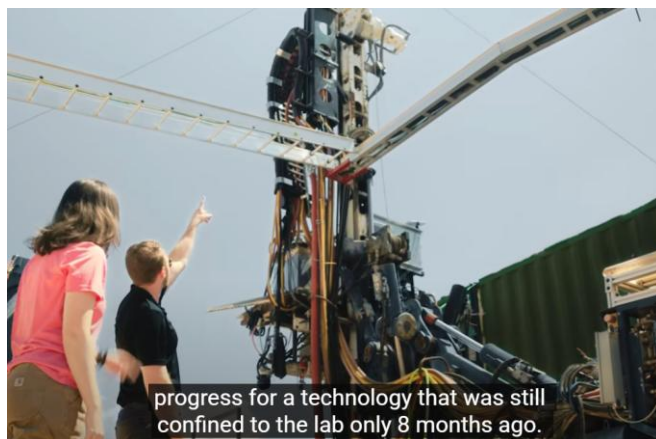
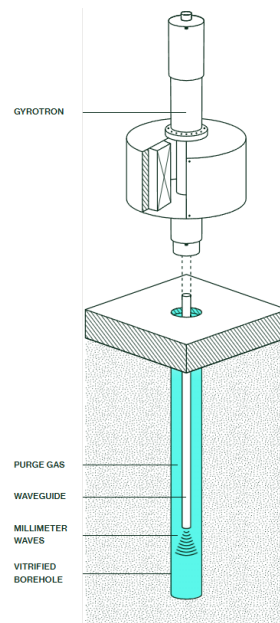
Link: <https://www.msn.com/en-us/news/technology/mit-spinoff-achieves-major-milestone-in-pursuit-of-limitless-energy-beneath-our-feet-could-fundamentally-change-how-we-power-our-world/ar-AA1KOf5n>

See video here: <https://www.youtube.com/watch?v=oYHcCsFID2Q>

See also: <https://www.quaise.com/>

Our gyrotron-powered drilling platform vaporizes boreholes through rock and provides access to deep geothermal heat without complex downhole equipment.

Based on breakthrough fusion research and well-established drilling practices, we are developing a radical new approach to ultra-deep drilling. First, we use conventional rotary drilling to get to basement rock. Then, we switch to high-power millimeter waves to reach unprecedented depths.



- Geothermal energy offers limitless heat from beneath Earth's surface. It could dramatically expand grid output, reduce costs, and eliminate reliance on fossil fuels. *[My comment -The news here has to do with a radical alternative to current technologies for drilling deep into the Earth to tap geothermal energy. Below is a recap of current techniques].*

- **Side note** - Common Drilling Techniques for Geothermal Wells
 - 1. Rotary Drilling (Conventional)
 - Most widely used for deep geothermal wells.
 - A rotating drill bit grinds through rock while drilling fluid (mud) cools the bit and carries cuttings to the surface.
 - Requires high-temperature-resistant equipment due to extreme subsurface heat.
 - 2. Air Drilling
 - Used in dry formations or where water-based mud might damage the reservoir.
 - Compressed air replaces drilling mud to lift cuttings.
 - Reduces risk of formation damage and improves penetration rate in certain rock types.
 - 3. Coiled Tubing Drilling
 - A flexible, continuous tube is used instead of traditional drill pipe.
 - Offers faster deployment and is useful for directional drilling or re-entry into existing wells.
- Here's the news - [Quaise Energy](#), an MIT spinoff, has successfully drilled 100 meters [*that's 330 feet approximately*] into superhot rock using millimeter wave technology.
- This is the first time such drilling has succeeded outside a lab setting, marking a major milestone.
- The technique uses millimeter waves to vaporize rock at temperatures around 752°F (400° Celsius). Millimeter waves are high-frequency electromagnetic waves (30–300 GHz) with wavelengths between 1–10 mm.
- Here's how the drill system works:
 - **Dielectric Heating:** Similar to microwave ovens, millimeter waves heat rock by exciting molecules, causing them to vibrate and break apart. This vaporizes the rock into fine ash.
 - **Gyrotron Source:** A device called a gyrotron generates millimeter waves. These are powerful enough to reach temperatures that melt or ablate tough basement rock like granite and basalt.

- **Side note:** A gyrotron is a high-power vacuum electronic device that generates coherent electromagnetic radiation in the microwave, millimeter-wave, and even terahertz frequency ranges.
- **Waveguide Delivery:** millimeter waves are transmitted down a metallic pipe (waveguide) to the rock face. The beam is focused to maintain energy density and precision.
- **Non-Contact Drilling:** Unlike mechanical bits, millimeter waves don't touch the rock. This eliminates wear and tear, allowing deeper penetration without tool replacement.
- **Ash Removal:** A circulating gas flushes the vaporized rock ash to the surface, keeping the borehole clean and stable.



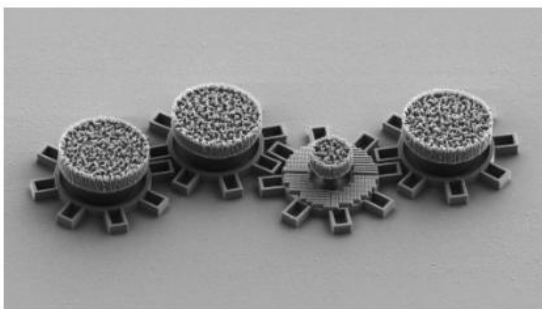
Story 3: Scientists build micromotors smaller than a human hair - *Tiny light-powered gears could revolutionize medicine by powering machines the size of human cells.*

Source: ScienceDaily.com

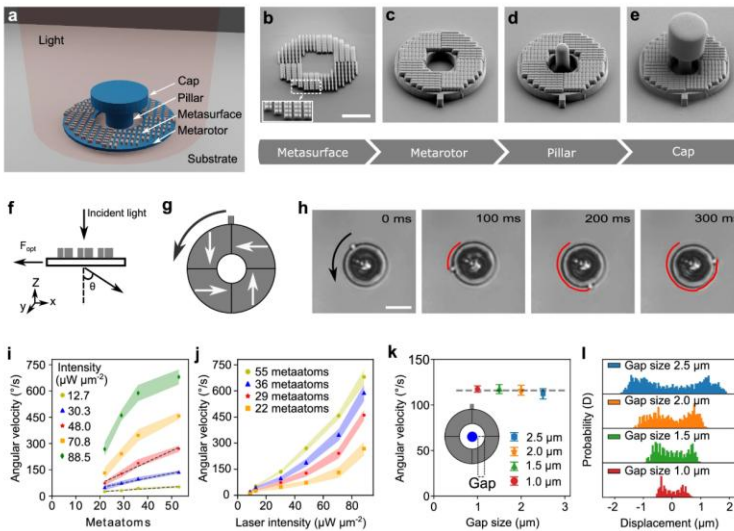
Story from University of Gothenburg

Link: <https://www.sciencedaily.com/releases/2025/09/250918025025.htm>

See research paper here: <https://www.nature.com/articles/s41467-025-62869-6>



The third gear from the right has an optical metamaterial that react to laserlight and makes the gear move. All gears are made in silica directly on a chip. Each gear is about 0.016 mm in diameter. Credit: Gan Wang



- Scientists at the University of Gothenburg in Sweden have built the smallest on-chip motors ever, with gears just 16–20 micrometers wide—smaller than a human hair.
- These gears are made of silica and etched directly onto a chip using traditional lithography.
- Instead of mechanical drive trains, the gears use optical metamaterials that respond to laser light.
 - **Side note** - What Are Optical Metamaterials?
 - Definition: Artificially structured materials designed to control electromagnetic waves—specifically light—at scales smaller than the wavelength itself.
 - Structure: They consist of periodic, nanoscale "cells" that act like artificial atoms. These cells are much smaller than the wavelength of light they interact with, allowing precise control over optical properties.
 - Functionality: Unlike conventional materials, their behavior isn't dictated by chemical composition but by geometry and arrangement of these subwavelength structures.

- Laser intensity controls speed; polarization controls direction. This enables motion without physical contact, allowing for rotation, linear movement, and even light deflection via micro-mirrors.
- Previous gear miniaturization stalled at 0.1 mm due to mechanical limits. This light-driven approach breaks the size barrier, opening doors to complex microsystems.
- These micromotors could act as pumps or valves inside the human body, regulating flows at the cellular level. Their size and precision make them ideal for lab-on-a-chip systems, nanomachines, and targeted therapies.
- Quote from Lead Researcher – *“This is a fundamentally new way of thinking about mechanics on a microscale.”*

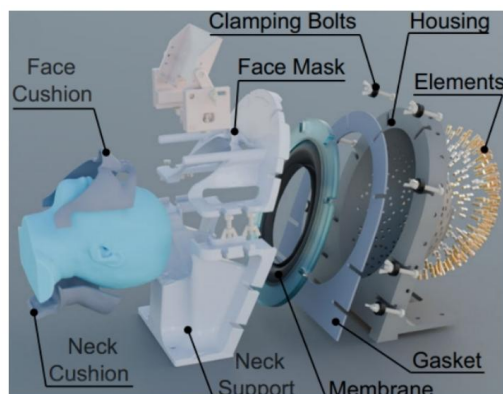
Story 4: New Ultrasound Helmet Reaches Deep Inside the Brain Without Surgery

Source: ScienceAlert.com

Story by Russell McLendon

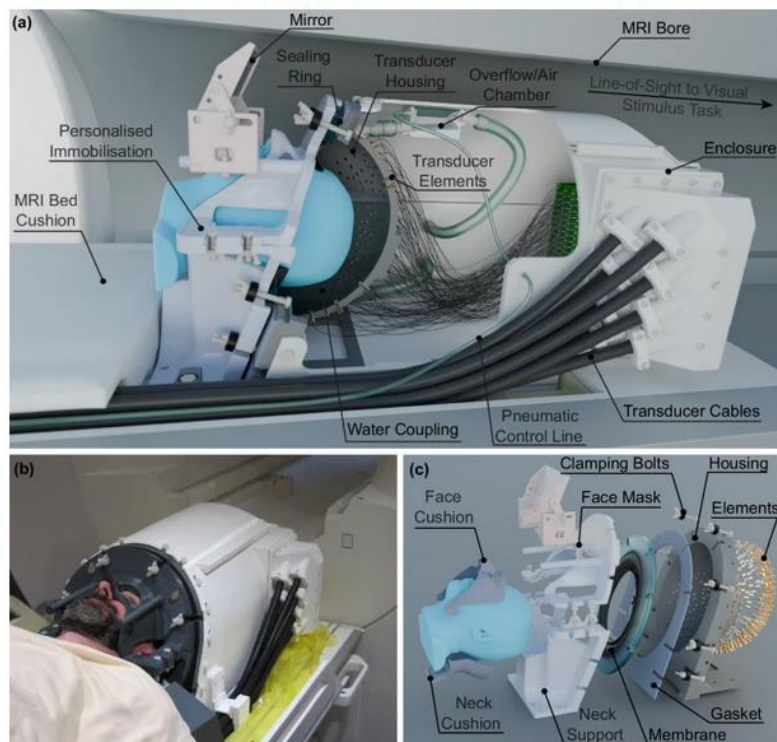
Link: <https://www.sciencealert.com/new-ultrasound-helmet-reaches-deep-inside-the-brain-without-surgery>

See research paper here: <https://www.nature.com/articles/s41467-025-63020-1>



A schematic of the ultrasound helmet. (Martin et al., Nat. Comm., 2025)

Fig. 1: Advanced transcranial ultrasound system setup and components.



a Advanced transcranial ultrasound system within the MR bore, used for concurrent neuromodulation and functional neuroimaging. The participant is immobilised and coupled to the transducer array using water. The participant has a line of sight to a visual stimulus task outside of the bore, via a mirror. **b** Participant positioned within the system on the MR table. **c** Exploded view of the personalised immobilisation hardware, showing the sealing membrane and gaskets which retain water between the participant's head and transducer bowl.

- Deep-brain structures like the basal ganglia or the thalamus wield major influence on our behavior. If something goes awry, dysregulation in the deep brain may trigger neurological conditions [like Parkinson's disease](#) or [depression](#).
- Despite the clear importance of these structures, our knowledge about them remains limited by their location, making them difficult to study and treat.
- In a new study, researchers from University College London, in collaboration with the University of Oxford's Nuffield Department of Clinical Neurosciences, document a new device that might offer an alternative to invasive procedures. Featuring a novel ultrasound helmet, it not only modulates deep-brain circuits without surgery but reportedly can do so with unrivaled precision.
- How the Ultrasound Helmet Targets the Brain:

- The helmet uses an array of 256 ultrasound emitters arranged inside its shell. These emit focused beams that converge precisely on deep-brain targets.
 - It can stimulate regions 1,000× smaller than conventional ultrasound and 30× more precise than other deep-brain devices.
 - Targeting Mechanism: A soft plastic face mask stabilizes the head, ensuring accurate delivery of ultrasound pulses.
 - Real-Time Monitoring: The system is compatible with fMRI [functional Magnetic Resonance Imaging], allowing researchers to observe brain activity as it happens.
- One of the lead researchers noted, *"The ability to precisely modulate deep-brain structures without surgery represents a paradigm shift in neuroscience, offering a safe, reversible, and repeatable method for both understanding brain function and developing targeted therapies."*

Honorable Mentions

Story: NASA Is Testing a Nuclear Battery That Could Last 433 Years

Source: Popular Mechanics

Story by Elizabeth Rayne

Link: <https://www.popularmechanics.com/science/a65964293/nuclear-battery-433-years/>



Vertigo04 // Getty Images

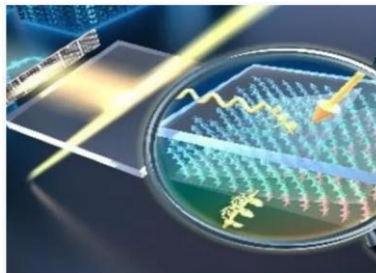
- **What It Is:**
 - A **coin-sized nuclear battery** that uses **nickel-63 isotopes** as its energy source.
 - Converts radiation into electricity using a **diamond semiconductor**—specifically, a layer of artificial diamond that captures beta particles.
 - **How It Works**
 - Nickel-63 emits **low-energy beta radiation**, which is safe and easily shielded.
 - The diamond layer absorbs this radiation and converts it into a small but steady electric current.
 - The battery is encased in a **radiation-proof shell**, making it safe for use in consumer and industrial applications.
 - Ideal for **space missions, medical implants, deep-sea sensors**, and **remote infrastructure**—anywhere long-term, maintenance-free power is needed.
 - Could revolutionize **IoT devices**, especially those in hard-to-reach or hazardous environments.
 - Offers a **maintenance-free power source** for centuries.
 - Represents a major leap in **energy density and longevity** compared to traditional batteries.
 - Opens doors to **sustainable, long-duration technologies** without the need for recharging or replacement.

Story: China's transparent coating to turn ordinary windows into solar power generators

Source: Interesting Engineering

Story by Georgina Jedikovska

Link: <https://interestingengineering.com/energy/colorless-coating-turn-windows-into-solar-panels>



This semi-transparent solar concentrator uses liquid crystal films to reflect and guide circularly polarized sunlight, enabling colorless energy harvesting for next-generation green buildings. Center for Liquid Crystal and Photonic Imaging, Tsinghua University

- Researchers at Nanjing University developed a transparent, colorless solar concentrator coating.
- It can be applied directly to standard window glass without altering appearance.
- Uses cholesteric liquid crystal (CLC) multilayers with submicron lateral periodicities.
- Selectively diffracts circularly polarized light, guiding it into the glass at steep angles.
- Light is directed to the edges of the window, where photovoltaic (PV) cells are installed
- Unlike luminescent or scattering-based concentrators, this coating:
- Maintains visual clarity (no distortion).
- Offers broadband, polarization-selective diffraction.
- Enables efficient waveguiding for energy harvesting.
- Is scalable and potentially cost-effective.

Story: Scientists Pitch Bold Plan to Turn Nuclear Waste Into Nuclear Fuel -

Tapping into discarded nuclear waste could help generate a self-sufficient source of a key ingredient for nuclear fusion, a new plan proposes.

Source: Gizmodo

Story by Gayoung Lee

Link: <https://gizmodo.com/scientists-pitch-bold-plan-to-turn-nuclear-waste-into-nuclear-fuel-2000643875>



- A bold new proposal from Terence Tarnowsky, a nuclear physicist at Los Alamos National Laboratory, aims to solve one of fusion energy's biggest bottlenecks: the scarcity of tritium. His team suggests repurposing radioactive waste—specifically spent nuclear fuel—as a source for tritium production.
- Key Points:
 - Fusion vs. Fission: Fusion uses tritium and deuterium to generate energy, unlike current fission reactors that split heavy atoms like uranium and produce long-lived waste.
 - Tritium Crisis: Tritium is rare, unstable, and decays quickly (half-life: 12.3 years). Global supplies are dangerously low.
- The Proposal:
 - Use a superconducting linear accelerator to bombard nuclear waste surrounded by molten lithium salt.
 - This process would trigger neutron bursts and nuclear transitions that produce tritium.
- Tarnowsky estimates this method could yield over 10× more tritium than a fusion reactor of equivalent thermal power.
- Challenges Ahead:
 - Requires major investment and long-term planning.
 - Tritium cannot be stockpiled easily due to its decay and hydrogen-like behavior.
 - Nuclear waste continues to accumulate—about 2,000 metric tons annually in the U.S.—adding urgency to the problem.
- Tarnowsky remains optimistic, noting that public perception of nuclear energy is shifting, and the fusion conversation is finally gaining traction.

Story: Scientists Made 'Jelly Ice' That Never Melts. It's Edible, Compostable and Reusable

Source: ZME Science

Story by Tibi Puiu

Link: <https://www.zmescience.com/science/news-science/scientists-made-jelly-ice-that-never-melts-its-edible-compostable-and-reusable/>



© Jelly ice is a reusable and compostable cooling material that doesn't melt into a mess like regular ice. Credit: Jiahua Zou.

- What Is Jelly Ice?
 - A reusable, compostable cooling material developed by researchers at UC Davis.
 - It looks like Jell-O, but functions like ice—without melting into liquid.
 - Composed of 90% water, held in a gelatin-based hydrogel structure.
- Scientific Inspiration
 - Originated from a food safety concern: meltwater in seafood displays can spread pathogens.
 - Inspired by tofu's water retention and refined using gelatin, which forms hydrogels that trap water even during freeze-thaw cycles.
- Practical Benefits
 - Doesn't leak or create puddles, reducing contamination risks.
 - Can be washed, frozen, thawed, and reused multiple times.
 - Edible and biodegradable, making it environmentally friendly.