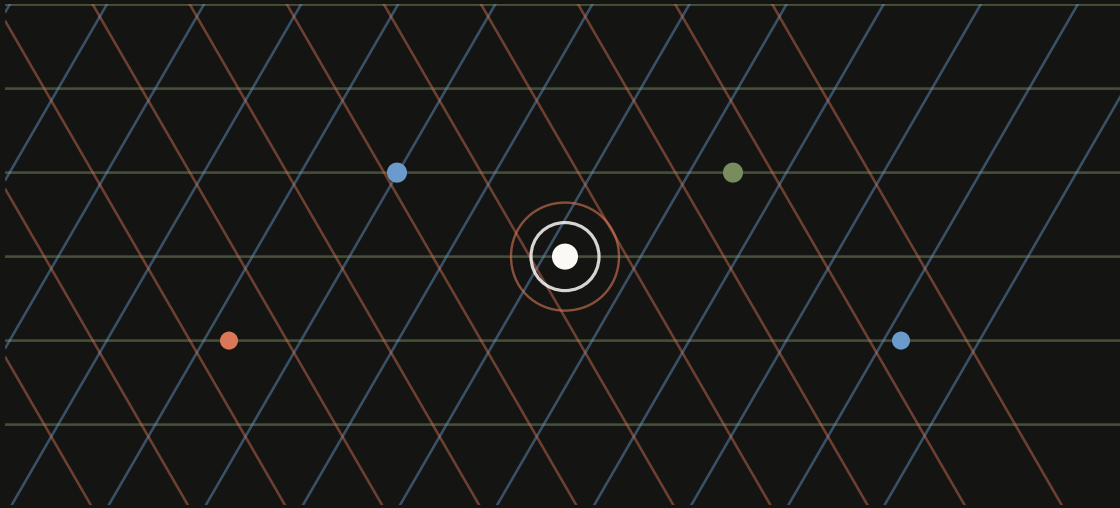




THE FEATURE

The year's most important superconductor is almost *useless*.

Two new materials work only a whisper above absolute zero. Yet the way physicists found them — a machine sifting a near-infinite space of matter — may outrank any single discovery. This week, superconductivity stopped being a lottery and became a search.

- Why a flat band makes electrons hold perfectly still
- The 151-kelvin record no one else can yet repeat
- Against the Grain — the room-temperature mirage

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DISPATCH · EDITOR'S NOTE

The oracle is worth more than the answer.

This week two labs pushed the superconductivity story forward — one in Texas, one in Finland — and both will be misread. The Texas result, a new temperature record, is the one that *sounds* enormous. The Finnish result, two materials that barely superconduct at all, is the one that actually matters.

We are trained to watch for the destination: the room-temperature superconductor that would rewire the power grid, the data center, the hospital. But the Finnish team did not ship a destination. They shipped a vehicle — a way to search the map of matter with a machine instead of a century of luck. Artificial intelligence already taught us this lesson once. AlphaFold's value was never its first predicted protein; it was that protein structure had become *searchable*.

So read this issue with one question in mind. When did the artifact stop being the prize, and the search engine become it? That quiet inversion — unglamorous, and suddenly everywhere in 2026 — is this week's real news.

— THE EDITORS

The Search Engine for Superconductors

An international team taught a machine to hunt through a practically infinite space of materials. It found two. Both are nearly useless — and that is exactly the point.

BY THE EDITORS OF INFLECTION

For one hundred and fourteen years, the hunt for superconductors has been a treasure hunt without a map. In 1911 Heike Kamerlingh Onnes chilled a thread of mercury to within four degrees of absolute zero and watched its electrical resistance fall — not gently, but to exactly nothing. Every electron dropped into lockstep. It was one of the strangest things anyone had ever seen, and for more than a century almost every superconductor found afterward was found the same way Onnes found the first: by accident.

Physicists have since catalogued more than seven thousand of these materials. By the reckoning of Aalto University's Päivi Törmä, only about twenty were ever predicted from theory before someone stumbled on them in a lab. The rest were luck.

The reason is brutal arithmetic. Superconductivity is a many-body quantum problem, in which the behavior of each electron depends on all the others at once, and the space of possible materials — which elements, in which lattice, in which ratio — is effectively infinite. Confirming a single candidate with full first-principles physics can devour days of

supercomputer time. Searching the whole space one material at a time would outlast the patience of the universe.

So the field has been trapped in a paradox. The tool that can *confirm* a superconductor — rigorous computation — is far too slow to search with. And the tool fast enough to search — human intuition — is far too blind to trust. On the seventeenth of June, in the journal *Physical Review Research*, a team spanning Finland, the United States and beyond published a way out of the trap.

A basket-weave for electrons

The trick begins with geometry. The two new materials — YRu_3B_2 and its heavier cousin LuRu_3B_2 — arrange their ruthenium atoms into a *kagome* lattice, the interlocking triangle-and-hexagon pattern of a woven bamboo basket. (Kagome is Japanese for precisely that weave.) The shape does something remarkable to electrons.

In an ordinary metal, an electron's energy climbs with its speed, like a marble accelerating down a slope; the fast ones are hard to pair. But in a kagome lattice the electron waves interfere so that an entire band of states shares almost the same energy no matter its momentum — a "flat band." Picture a marble resting on a perfectly level tray. It has nowhere it wants to roll. Electrons in a flat band effectively hold still, crowd together in density, and — coaxed by their mutual repulsion and attraction —

pair off into the coordinated march that superconductivity demands.

Pre-screen, then compute

Törmä's SuperC consortium — founded in 2023 with the blunt goal of finding a room-temperature superconductor by 2033 — turned that insight into a filter. Instead of computing every candidate, they let a machine-learning model make a fast, cheap first pass across a vast list of elemental combinations, flagging those whose electronic structure hinted at the right flat-band geometry. Only the survivors earned the expensive, rigorous first-principles treatment. The shortlist went to Rice University, where Emilia Morosan's group synthesized the compounds and measured them — magnetization, specific heat, electrical transport — to confirm the resistance truly vanishes.

"With machine learning, we may be able to push the number of materials we can process into the billions."

PÄIVI TÖRMÄ • AALTO UNIVERSITY • SUPERC

The measured payoff sounds almost comic. YRu_3B_2 superconducts only below 0.81 kelvin; LuRu_3B_2 below 0.95 — colder than deep space, colder than nearly every superconductor already sitting in a physicist's freezer. As a *material*, it is a shrug. As a proof of concept, it is a starting gun: for the first time, a superconductor was not stumbled upon but *selected* — chosen by a machine from an ocean of possibilities, then made real on a bench.

Nothing you own will ever run on YRu₃B₂. It will not cool a data center or levitate a train. To ask whether these materials are *useful* is to make the same category error as asking whether AlphaFold's first predicted protein cured a disease. The deliverable was never the molecule. It was the map — and the machine that reads it.

What the SuperC team showed is that the predict-then-synthesize loop for superconductors can be closed by algorithm: narrow an infinite space to a shortlist, compute the shortlist, make the winners, measure them, feed the results back in. Today the funnel starts from known kagome families. But Törmä's claim is that the same pre-screening can widen to *billions* of candidate materials — a space no team of humans could ever hand-check. If even a sliver of those hide warmer transition temperatures, then the method, not the material, is the breakthrough of the decade.

Who should care first? Anyone whose roadmap secretly leans on better superconductors: MRI builders, quantum-computing hardware teams, grid engineers — and above all the fusion industry, which has poured more than fifteen billion dollars into reactors whose superconducting magnets are the entire game.

FIELD NOTES · HOW THE SEARCH WORKS

- 1 Pre-screen.** A machine-learning model sweeps a near-infinite list of element combinations, flagging those with promising flat-band, kagome-like structure. Cheap and fast.
- 2 Compute.** Survivors get rigorous first-principles physics to estimate electron pairing and a likely transition temperature — costly, but now run on a shortlist, not the haystack.
- 3 Make & measure.** Chemists synthesize the top picks; magnetization, specific-heat and transport tests confirm whether resistance really reaches zero.

GLOSSARY

Superconductor — a material that carries current with exactly zero resistance below a critical temperature.

Kagome lattice — a weave of corner-sharing triangles whose geometry can flatten electron energy bands.

Flat band — a set of electron states with nearly identical energy; the electrons move sluggishly and interact strongly, favoring pairing.

Critical temperature (T_c) — the temperature below which superconductivity switches on. Higher T_c means cheaper to use.

AGAINST THE GRAIN

The Room-Temperature *Mirage*

Here is the consensus you will read everywhere this month: superconductivity is on the cusp, a room-temperature material is coming, 2033 is the date. Believe none of the timeline and all of the method.

The Move 37 here — the play that looks like a blunder until you see the board differently — is the celebration of a 0.95-kelvin material. To a working engineer that number is a joke; it is colder than the superconductors we already discard. But the professionals are not cheering the material. They are cheering that a *machine* chose it. For the first time, finding a superconductor was an act of search rather than serendipity. The strategic prize of the decade is not the room-temperature superconductor. It is ownership of the screening oracle and the synthesis loop that finds it — the same flywheel logic that made AlphaFold, not any single protein, the asset.

Now the honest part, because the skeptics are not fools. First: flat-band superconductors may be intrinsically cold — the very geometry that makes them easy to predict may cap how warm they can ever get. Second: machine-learning screens learn from known families. They are superb at finding more kagomes and unproven at finding the genuinely unfamiliar; narrowing a haystack does not conjure a needle that was never in it. Third: the field is scarred. LK-99 detonated and fizzled in 2023, and even this year's headline 151-kelvin ambient-pressure record rests on a "pressure-quenching" technique from a group with a long, contested history of extraordinary claims others have struggled to reproduce.

So hold both thoughts at once. No useful material shipped this week — the skeptics are right. And a useful material was never the near-term deliverable — a compounding search process was. The mirage is the date on the calendar. The real thing is the engine now humming behind it.

1 sec**MEDICINE**

Researchers at Korea's KAIST unveiled a spray-on powder that stops life-threatening bleeding in roughly one second. Called AGCL, it reacts with calcium and other ions in blood to gel on contact, sealing the wound; it soaks up more than seven times its own weight in fluid and keeps for two years at room temperature through heat, humidity and pressure. Built with the South Korean military, it is aimed at battlefield and disaster trauma, where the first minute decides who lives.

SOURCE · SCIENCEDAILY / MEDICALXPRESS · JUNE 2026

24x**ROBOTICS**

Figure AI said its BotQ factory hit one humanoid robot per hour — a twenty-four-fold throughput jump in under 120 days — with more than 350 Figure 03 units delivered and a battery line running 99.3% yield. The target is 50,000 robots a year. The quiet payoff is not the robots; it is the identical fleet generating the real-world interaction data that trains their camera-to-motor "Helix" control model. The factory is a data pump wearing a hard hat.

SOURCE · FIGURE AI · 2026

1.65x**FUSION**

China's EAST "artificial sun" tokamak ran stable plasma at up to 1.65 times the Greenwald density limit — a boundary long assumed to trigger violent, machine-wrecking disruptions. By carefully governing how the plasma is started and how it touches the reactor wall, physicists reached what they call a "density-free" regime. Denser plasma means more fusion reactions per cubic meter, hinting at more compact and powerful reactor designs.

SOURCE · SCIENCE ADVANCES · 2026

7,000

superconductors catalogued since 1911 — nearly all of them found by accident.

~20

of those seven thousand, the number ever predicted from theory before being found.

0.95 K

transition temperature of the warmer new material, LuRu₃B₂ — that is -272.2 °C.

billions

candidate materials the team believes machine-learning can now pre-screen.

151 K

highest superconductivity ever *reported* at ambient pressure (Houston) — still awaiting independent replication.

2033

year the SuperC consortium has publicly pledged to find a room-temperature superconductor.

\$15.2B

private capital invested in fusion — an industry whose magnets live or die on superconductors.

1911

the year resistance first vanished in Onnes's mercury — and the century-long lottery began.

Line up this week's stories and a single shape appears. A superconductor found by a machine's search rather than a scientist's luck. A robot factory whose real output is the data exhaust of an identical fleet. A fusion plasma tamed not by a new material but by finer control of an old one. A powder that wins not by being clever but by being fast. In every case the headline artifact is a decoy; the durable asset is a *process that compounds*.

For most of the industrial age we prized discoveries — discrete objects, patented and shelved. 2026 keeps teaching a different lesson: the leverage has migrated to discovery engines, the loops that turn one search into a better next search. The room-temperature superconductor, when it finally arrives, will be found by a descendant of this month's model, trained on the failures of this month's attempt. The question for anyone building is no longer "what did you discover?" It is "what does your discovering get better at, each time you run it?"

Move 37 was never really a stone on a board. It was a glimpse of a system that had learned to look where humans don't — and kept the habit. That is the whole game now.

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INFLECTION.

THE WEEKLY MAGAZINE OF INNOVATION

NEXT ISSUE · FRIDAY 17 JULY 2026

THE LENS

*When the map of matter becomes **searchable**,
does the territory still have the power to
surprise us?*

Researched, written & designed with Claude. Typeset in Poppins & Lora on the Anthropic palette.
This week's cover weaves the three brand accents — clay, blue and green — into a kagome
lattice, the geometry at the heart of the issue.

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