AI & SCIENCE ISSUE

VOL. III · NO. 8 · AUGUST 2026

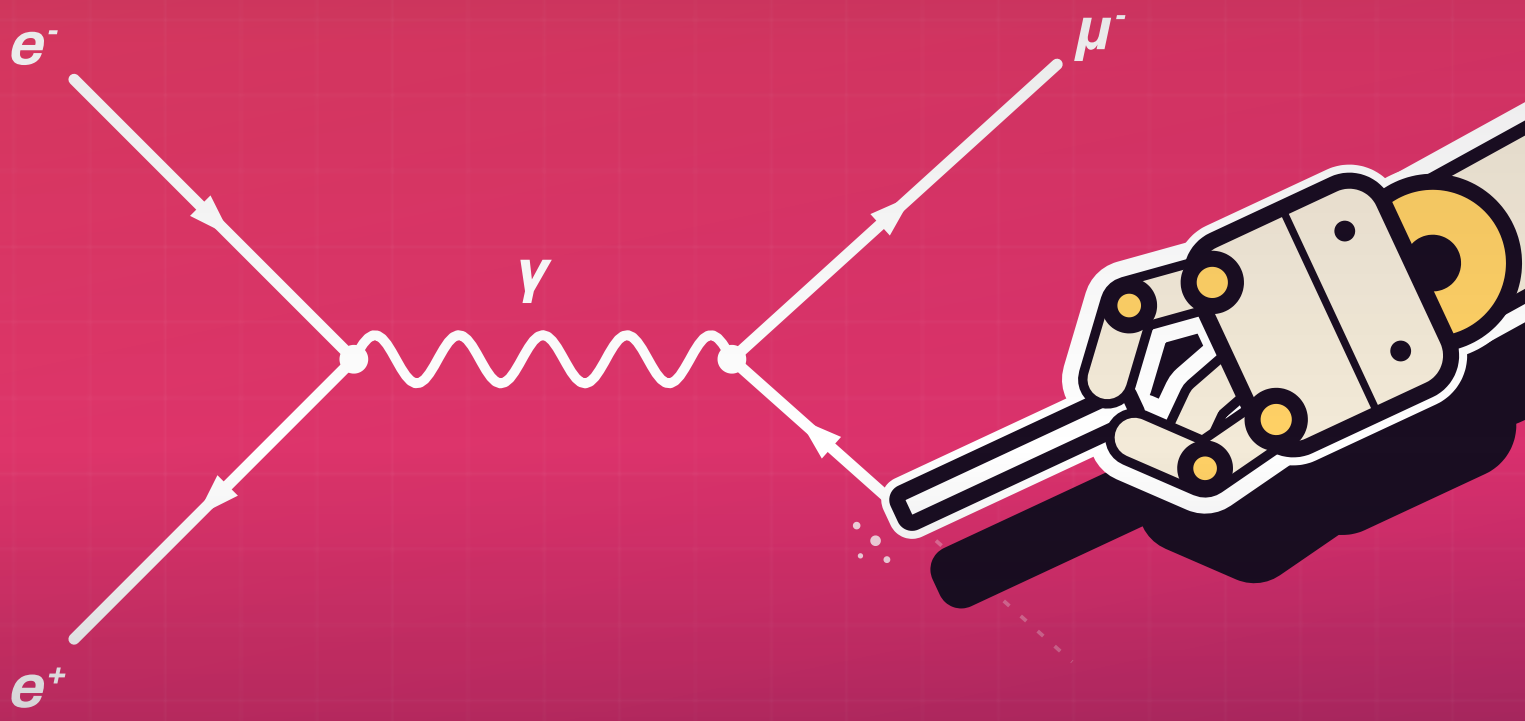
PUBLISHED SEPTEMBER 2026

PHYSICS PULSE

Your monthly physics digest

Department of Physics · IIT (ISM) Dhanbad

FIG. 1 — $e^+e^- \to \mu^+\mu^-$, TREE LEVEL



COVER STORY

AI FINDS THE NEEDLE

Searching 100 million possible recipes in just 40 experiments, an AI system has found a low-power way to 3D-print a NASA rocket alloy.

03 COVER STORY
AI cracks a hard-to-print NASA rocket alloy

04 SYMPOSIUM
ILMI 2026: intense-laser science at the centenary

05 PHYSICS EXPLAINED
Why a physics Nobel went to neural networks

PHYSICS PULSE

DEPARTMENT OF PHYSICS · IIT (ISM) DHANBAD · VOL. III · NO. 8 · AUGUST 2026

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FROM THE EDITORS

Welcome to the August edition of Physics Pulse. Our cover story follows an AI system that searched 100 million 3D-printing recipes to tame a NASA rocket alloy. Elsewhere, sunlight is used to make entangled photons, the department hosts the ILMI 2026 symposium on intense lasers, celebrates a new doctorate and an editorial appointment, an explainer traces how physics shaped neural networks, and we look back at three August milestones, among them the founding of India's Department of Atomic Energy. We hope you enjoy reading.

PHYSICS NEWS

COVER STORY · AI & MATERIALS PHYSICS

AI Searches 100 Million Recipes to 3D-Print a NASA Rocket Alloy

27 AUGUST 2026 · WASHINGTON STATE UNIVERSITY

GRCop-42, a copper–chromium–niobium alloy developed by NASA, keeps its strength at extreme temperatures while conducting heat well, which is why it lines liquid-fuelled rocket combustion chambers. It is also notoriously hard to 3D print: the process normally needs high laser power, and earlier attempts on ordinary commercial machines failed.

With more than **100 million** possible combinations of printing settings, and each trial costing material, money and days of analysis, testing them one by one was never an option. A team at **Washington State University** instead trained an AI model on 37 configurations that had already failed, then let it propose small batches of new ones, balancing promising bets against exploring the unknown.

In three months and just **40 experiments**, the system found six working configurations, including the first successful print of GRCop-42 at only **500 watts** of laser power. That could put the alloy within reach of the roughly 90% of commercial printers that previously could not handle it.

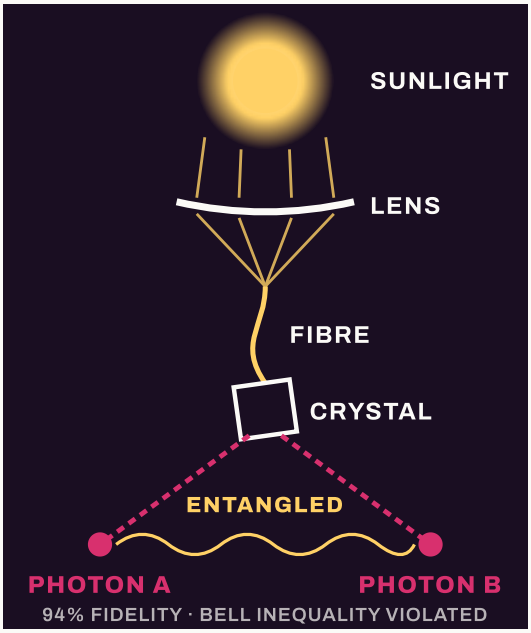
Every print, successful or not, improved the model, an approach the team says could carry over to other alloys and to any field where good results are rare and each experiment is expensive. The work appears in the *Proceedings of the AAAI Conference on Artificial Intelligence*.

READ MORE: DOI 10.1609/AAAI.V40I47.41428

QUANTUM OPTICS

Sunlight Makes Entangled Photons

7 AUGUST 2026 · *OPTICA*



Entangled photons are usually made by pumping a nonlinear crystal with a laser, because the process was thought to need highly coherent light. Researchers from the **University of Ottawa** and the **Max Planck Institute for the Science of Light** have now done it with sunlight.

The trick is that the entanglement lives only in the photons' **polarisation**, so it depends on how orderly the light oscillates, not on its colour or direction. A window-sized Fresnel lens and an all-glass concentrator funnelled sunlight into a hair-thin fibre and onto a millimetre-sized crystal.

In an outdoor test the photon pairs were about **94%** as entangled as an ideal state and violated Bell's inequality, opening a route to satellites that make encryption keys from sunlight.

READ MORE: DOI 10.1364/OPTICA.601797

ILMI 2026 BRINGS INTENSE-LASER SCIENCE TO THE CENTENARY CAMPUS

NATIONAL SYMPOSIUM ON INTENSE LASER MATTER INTERACTIONS 6–8 AUGUST 2026 · GJLT, IIT (ISM)



The traditional lamp-lighting opens ILMI 2026 at IIT (ISM) Dhanbad.

The Department of Physics hosted the **National Symposium on Intense Laser Matter Interactions (ILMI 2026)** from 6 to 8 August at the Golden Jubilee Lecture Theatre, one of the scientific events marking the institute's centenary year. It brought together faculty, scientists, postdoctoral researchers and Ph.D. students from universities and national laboratories across India, along with industry participants.

Welcoming delegates, convener **Prof. Amitava Adak** described the meeting as a platform for researchers in laser, plasma and ultrafast science to exchange ideas and identify future directions. Co-convener **Prof. Ritwik Mondal** outlined a programme of **eight technical sessions** with plenary lectures, keynote addresses, invited talks, and student oral and poster presentations.

Discussions ranged from ultra-high-intensity laser–matter interaction and laser-driven plasmas to high-harmonic generation, terahertz science, ultrafast magnetisation and spintronics, laser ablation and materials processing, and the development of India's next-generation high-intensity laser facilities.

SYMPOSIUM TOPICS

Science with high to ultrahigh intense lasers · Laser-driven plasma science · Theoretical and computational plasma physics · Ultrafast magnetisation dynamics · HHG, THz and interdisciplinary science · Pulsed laser ablation, deposition and LIBS

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AI & PHYSICS

WHY A PHYSICS NOBEL WENT TO NEURAL NETWORKS

01

BY PHYSICS PULSE DESK

The machines now running experiments and simplifying field theories were built from ideas physicists know well: energy landscapes, spins and the Boltzmann distribution.

In October 2024 the Nobel Prize in Physics went to **John Hopfield** and **Geoffrey Hinton** "for foundational discoveries and inventions that enable machine learning with artificial neural networks." Many readers asked why a computing prize belonged in physics. The answer is that both laureates borrowed their central tools straight from the physics of many interacting particles.

A MEMORY THAT ROLLS DOWNHILL

In 1982 Hopfield described a network of simple on–off "neurons," each connected to every other with a symmetric weight. He noticed that such a network behaves like a magnet made of tiny spins: every configuration has an **energy**, and the network's update rule always moves it downhill.

Store a set of patterns by shaping the weights, and each pattern becomes a valley in that energy landscape. Show the network a smudged or partial pattern and it slides into the nearest valley, recovering the stored memory. Remembering becomes relaxation to a minimum, the same physics that settles a spin system into its ground state.

The analogy also set the network's limits. A Hopfield network of N neurons can reliably hold only about $0.14N$ random patterns; beyond that, memories blur into spurious mixtures.

LEARNING WITH TEMPERATURE

Hinton, with Terrence Sejnowski, took the next step in the mid-1980s with the **Boltzmann machine**. Instead of rolling deterministically downhill, its units flip at random, with probabilities set by the Boltzmann distribution from statistical mechanics. Hidden units let the network discover structure that no one wrote down.

Training adjusts the weights until the network's own "thermal" fluctuations reproduce the statistics of the data it is shown. In 2006 Hinton and colleagues used stacks of simplified, restricted Boltzmann machines to pre-train deep networks, part of the chain of ideas that led to today's deep learning.

The link is more than an analogy. The mathematics that tells a gas how to share its energy among many molecules tells the machine how likely each internal state should be, so learning becomes a problem in statistical physics.

Remembering becomes relaxation to a minimum, the same physics that settles a spin system into its ground state.

WHY A PHYSICS NOBEL WENT TO NEURAL NETWORKS — CONTINUED

NOW THE DEBT IS BEING REPAID

Neural networks have since returned to physics as working instruments. Machine-learning classifiers help particle physicists separate rare signals from enormous backgrounds in collider data. Similar tools search detector streams for gravitational-wave candidates, sort galaxies in sky surveys and screen candidate materials before anyone synthesises them.

In materials science, spectroscopy and astrophysics, learned models increasingly act as a fast first filter, flagging the few candidates worth a slower and more careful calculation.

The 2024 Nobel Prize in Chemistry, awarded for protein structure prediction and design, made the same point from another direction: a learned model can now predict the folded shape of a protein from its sequence, a problem that resisted direct calculation for half a century.

PHYSICS INSIDE THE NETWORK

Learned models now also decide which experiment to run next. This issue's cover story is an example: an AI system steered a search through 100 million 3D-printing settings and found working recipes in just 40 trials. Others go further and build the symmetries of a physical problem directly into the network, so its answers respect the underlying laws by construction.

The approach has limits. A network can fit data without revealing why, and a prediction that cannot be interrogated is a weak substitute for understanding. Much current work therefore aims at models whose internal structure physicists can read, test and trust.

Physicists have also turned the question around and asked what the networks themselves are. Tools from statistical mechanics and field theory are now used to explain why very large networks train as well as they do, a debt repaid in the other direction.

KEY IDEAS

Energy landscape

A map of energy over every possible state. Stored memories and trained solutions sit in its valleys.

Ising-type spins

Two-state units coupled to their neighbours: the physicist's model of a magnet, and Hopfield's model of a neuron.

Boltzmann distribution

The probability of a state falls off exponentially with its energy divided by temperature. Boltzmann machines sample from it.

Physics-aware networks

Architectures that obey a system's symmetries by construction, so they need less data and generalise better.

DEPARTMENT NEWS

PH.D. AWARDED

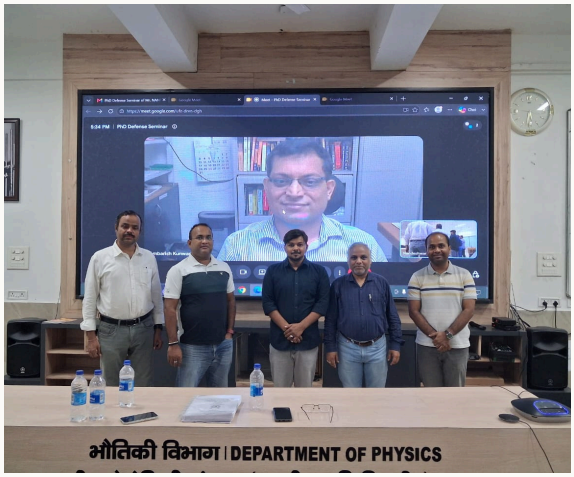


Dr. Jyotsna Patra Defends Her Thesis on Laser-Made Plasmonic Nanoparticles

29 AUGUST 2026 · SUPERVISOR: PROF. AMITAVA ADAK

Congratulations to **Dr. Jyotsna Patra**, who successfully defended her Ph.D. thesis, *"Synthesis of Ultrasmall Plasmonic Nanoparticles by Pulsed Laser Ablation for Biorelevant Applications,"* under the guidance of **Prof. Amitava Adak**. Part of the work appears this month in *Nanoscale* (see Research Publications).

PH.D. AWARDED



Dr. Nandeshwar Earns His Ph.D. in Computational Biophysics

13 AUGUST 2026 · SUPERVISOR: PROF. UMAKANTA TRIPATHY

Congratulations to **Dr. Nandeshwar**, awarded his Ph.D. for the thesis *"Computational Exploration of Ligand-Induced Conformational Dynamics: Targeting Structurally Flexible Disease-Associated Proteins,"* supervised by **Prof. Umakanta Tripathy**.

FACULTY

Prof. Manu Kurian Joins the Editorial Board of *Scientific Reports*

Prof. Manu Kurian has been selected as an Editorial Board Member of *Scientific Reports*. The department congratulates him.

STUDENT RESEARCH · QMAT 2026

Quantum Matter Group at QMAT 2026, JNU

Ankur Majumder, **Prithwish Karak** and **Tirthankar Ghosh** of the Quantum Matter Research Group attended *QMAT 2026*, the annual conference on quantum condensed matter at Jawaharlal Nehru University, New Delhi, gaining fresh perspectives on their own research.

STUDENT RESEARCH · SINGAPORE

Aminul Hussain at NUS School on 2D Quantum Materials

Aminul Hussain attended *Novel Frontiers in Two-Dimensional Quantum Materials* at the National University of Singapore, a summer school on 2D and moiré systems. Highlights included meeting 2010 Nobel laureate **Prof. Konstantin Novoselov**.

THIS MONTH IN PHYSICS HISTORY

03

AUGUST 1954

India Establishes the Department of Atomic Energy

On 3 August 1954, a Presidential Order created the **Department of Atomic Energy (DAE)**, placed under the direct charge of the Prime Minister. It was set up to oversee government work on atomic energy and the peaceful applications of nuclear science and technology.

Its founding was a milestone in India's organised nuclear programme and in the pursuit of indigenous capability in nuclear science.

12

AUGUST 1960

Echo 1A, the First Passive Communications Satellite

NASA launched *Echo 1A*, a 30-metre balloon with a metallic coating. It carried no transmitter: it simply reflected radio waves from one ground station back down to another.

Its success showed what space-based communication could do.

19

AUGUST 1960

Belka and Strelka Return Safely from Orbit

The Soviet Union launched *Korabl-Sputnik 2* (Sputnik 5) carrying the dogs **Belka** and **Strelka** with other biological specimens. The craft completed 17 orbits in about 24 hours and returned safely on 20 August.

The mission revealed how spaceflight affects living organisms and tested the life-support and recovery systems needed for human flight.

JOB & FUNDING OPPORTUNITIES

Ramanujan Fellowship

ANRF · for Indian scientists returning from abroad

Supports scientists of Indian origin working overseas who want to take up research positions in India.

CHECK PORTAL FOR CURRENT CALL

anrf.gov.in

Advanced Research Grant (ARG): Full Proposals

ANRF · for faculty and scientists

Funding for established investigators pursuing ambitious, long-horizon research programmes.

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Inclusivity Research Grant (IRG)

ANRF · research grants for SC/ST researchers

Dedicated research support aimed at widening participation in Indian science.

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Prime Minister Early Career Research Grant

ANRF · for early-career faculty

Helps researchers in their first faculty years set up independent groups.

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National Postdoctoral Fellowship (N-PDF)

ANRF · for early-career Ph.D. holders

Postdoctoral fellowships hosted at Indian institutions for recent doctorates.

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anrf.gov.in

Postdoctoral Fellowships

Raman Research Institute, Bengaluru

Positions across astronomy and astrophysics, light and matter physics, soft condensed matter and theoretical physics.

CHECK PORTAL FOR CURRENT CALL

rri.res.in

Calls open and close through the year. Check each official portal for current deadlines and eligibility before applying. Know of an opening? Send it through the newsletter form.

RESEARCH PUBLICATIONS

1

Ashes Modak, Anowar Shaikh, Manu Kurian, Binata Panda and Sadhana Dash

Electromagnetic response of a relativistic drifting plasma

Physical Review D (2026) · DOI: 10.1103/sl21-xj4r

2

Jyotsna Patra, Govind Chouhan, Pratyush Dash, Manika Dandapat, Satyaranjan Satyajit, Umakanta Tripathy, Sheeja Jagadevan and Amitava Adak

Study of antimicrobial effects of laser-engineered SERS-active Cu@Cu_2O nanostructures and their compatibility with human embryonic kidney cells

Nanoscale 18 (21), 11220–11231 (2026) · DOI: 10.1039/d6nr00142d

3

Poulami Das, Subhankar Nanda, Satyaranjan Satyajit and Amitava Adak

Spatio-temporal dynamics of laser-driven plasma-shock evolution in nickel: onset of shock front detachment

Journal of Physics D: Applied Physics 59 (25), 255203 (2026) · DOI: 10.1088/1361-6463/ae7c81

4

Poulami Das, Satyaranjan Satyajit, Subhankar Nanda and Amitava Adak

Propagation dynamics of shockwave via intense laser–solid interaction in ambient air: strong-to-weak shock transition

Physics of Fluids 38 (8) (2026) · DOI: 10.1063/5.0344812

5

Smruti Ranjan Parida, Soumendra Kumar Das, Paramjit Kour and Sridhar Sahu

Synergistic H_2–CH_4 co-adsorption on scandium-decorated [5]cycloparaphenylene nanohoops for gas storage application

Chemistry – An Asian Journal (2026) · DOI: 10.1002/asia.70942

6

Batistalang Myrthong and Ram Bilash Choudhary

Engineering polypyrrole with varying concentration of zinc molybdate for supercapacitor electrode materials

Energy Storage (Wiley, 2026)

7

Sandipan Dutta, Ram Bilash Choudhary and Raushan Kabir

Redox-active 9,10-phenanthrenequinone-derived polymeric composite (PQ/PPY/MWCNTs) material for supercapacitor electrode application

Journal of Materials Science: Materials in Electronics 37, 1926 (2026)

“

WHAT I CANNOT CREATE, I DO NOT UNDERSTAND.

RICHARD FEYNMAN · ON HIS BLACKBOARD AT CALTECH, 1988

PHYSICIST, NOBEL LAUREATE AND LIFELONG BONGO PLAYER



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