

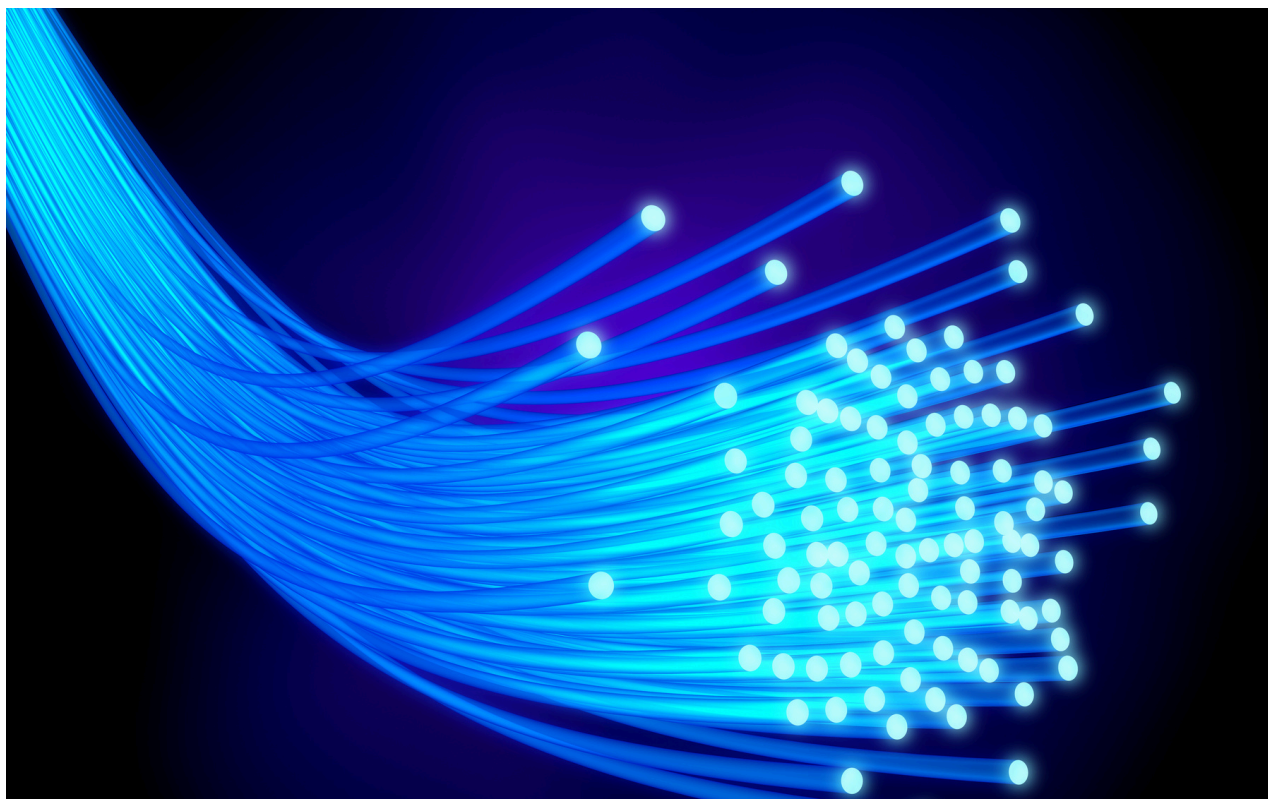


# SCIENCE AND TECHNOLOGY PULSE

VOL. 2 ISSUE 2

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## Transforming Optoelectronics: Plasma-Stabilized Perovskite LEDs Take the Lead

***This innovation enables lighting companies to develop long-lasting, high-efficiency PeLEDs for smart lighting and signage. Display manufacturers can integrate PeLEDs into next-gen screens with improved color stability and durability, enhancing consumer electronics.***

Researchers at the Centre for Nano and Soft Matter Sciences (CeNS), Bengaluru, have developed a novel method to address the challenges of anion migration in perovskite nanocrystals, a key issue limiting the performance of perovskite LEDs (PeLEDs). By synthesizing cesium lead bromide ( $\text{CsPbBr}_3$ ) nanocrystals and applying argon-oxygen ( $\text{Ar-O}_2$ ) plasma treatment, the team created a cross-linked, hydrophobic layer that stabilizes the nanocrystals and significantly reduces anion migration.

This advancement improves the heat and moisture resistance of PeLEDs while enhancing their color stability, making them more viable for next-generation optoelectronic devices. Published in the journal *Nanoscale*, this research offers a pathway to durable and efficient lighting technologies.

In this newsletter  
you can expect  
updates from:

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Emerging Technologies

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Government Initiatives

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Food and Agriculture

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Environmental Science

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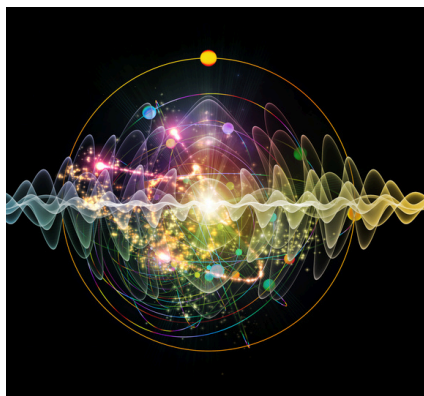
Health and Medicine

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Space Exploration

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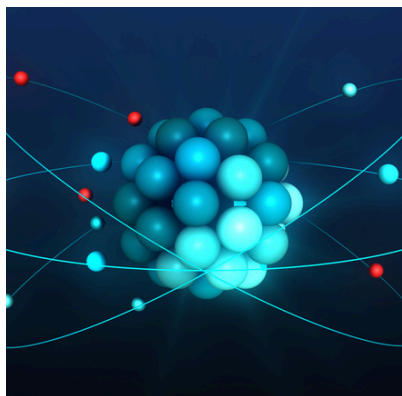




## From Lab to Life: IIT Bombay's Quantum Sensors Ready for Real-World Impact

***Industries can leverage this technology for high-precision chip testing, enhancing semiconductor quality control, and improving neurological diagnostics in healthcare. Defense and surveillance sectors can integrate portable magnetometers for advanced security, while mining companies can develop quantum-grade diamonds for specialized applications.***

IIT Bombay's Photonics and Quantum Sensing Technology Lab, led by Prof. Kasturi Saha, is advancing quantum technologies like the quantum diamond microscope and portable magnetometer. Using Nitrogen Vacancy (NV) centers in lab-grown diamonds, these devices offer high magnetic sensitivity for applications in semiconductor testing, neuron mapping, and drone surveillance. As part of the National Quantum Mission, the lab bridges quantum science with real-world engineering to push the limits of precision sensing.



## Cold Atoms, Hot Tech: Quantum Research Fuels Future Materials Innovation

***This research benefits electronics, energy storage, and materials science industries by enabling the development of faster nanoscale chips, high-capacity smart batteries, and efficient conductive materials. These advancements improve device performance, energy efficiency, and sustainability across various applications.***

Scientists at the Raman Research Institute (RRI) have studied ultra-cold potassium atoms near absolute zero, revealing unexpected oscillations in their transport dynamics under laser interactions. Using a Magneto-Optical Trap (MOT), they uncovered new quantum transport behaviors, which could inspire high-efficiency materials for next-gen batteries and nanoscale electronics. Published in *Optics Letters*, the research advances semiconductor and energy storage technologies.



## Next-Gen Smart Windows: Self-Charging, Color-Changing Tech for Energy-Efficient Buildings

***This technology allows construction firms to develop energy-efficient buildings with self-powered smart windows, reducing reliance on external power sources. Renewable energy companies can integrate them with solar panels, creating sustainable, self-sufficient smart homes for modern urban development.***

Researchers at the Centre for Nano and Soft Matter Sciences (CeNS) have developed next-generation smart windows that can change color and store energy simultaneously, eliminating the need for external power sources. These windows utilize tungsten oxide ( $\text{WO}_3$ ) and zinc-ion batteries, enabling 50% light modulation, self-charging in just 10 minutes, and stability over 3000 cycles. Published in *Energy Storage Materials*, this innovation merges aesthetics with energy efficiency, offering a sustainable solution for modern architecture and reducing reliance on traditional power sources in buildings.

TODAY ISSUE PRESENTS:

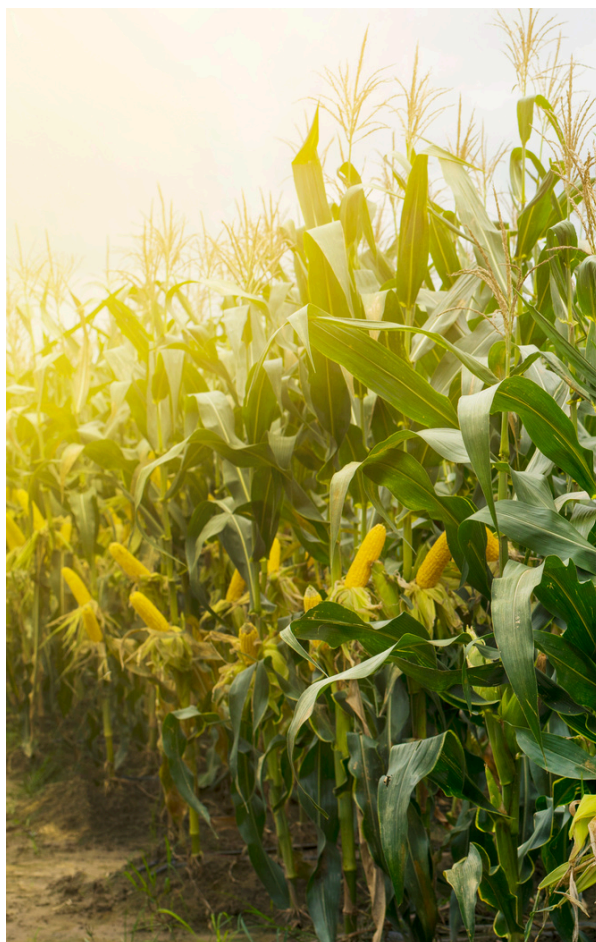
# Research

major changes on Earth. We Among other things will  
will visit several places of also discuss new measures

## Catalyzing Discovery: ANRF's J. C. Bose Grant Ignites India's Research Revolution

***This grant will drive cutting-edge R&D in biotech, AI, and renewable energy, creating commercial opportunities for industries in technology, healthcare, and manufacturing. Enhanced collaboration between academia and industry will accelerate product innovation and global competitiveness.***

The Anusandhan National Research Foundation (ANRF) has introduced the J. C. Bose Grant (JBG) to support senior Indian scientists and engineers with a proven track record of excellence in science, technology, agriculture, medicine, and humanities. This initiative offers annual funding of Rs. 25 lakhs for five years, along with Rs. 1 lakh overhead costs to institutions, enabling researchers to pursue cutting-edge projects even post-retirement, up to the age of 68. By recognizing outstanding contributions through publications, patents, and awards, the grant aims to strengthen India's research ecosystem and foster innovation.



## Rooting for Resilience: How Corn Plants Hunt for Water and What It Means for Agriculture

***Agriculture and seed development industries can use these insights to cultivate drought-resistant corn varieties, improving water efficiency and crop yields in arid regions. This innovation supports sustainable farming practices and enhances food security amid climate challenges.***

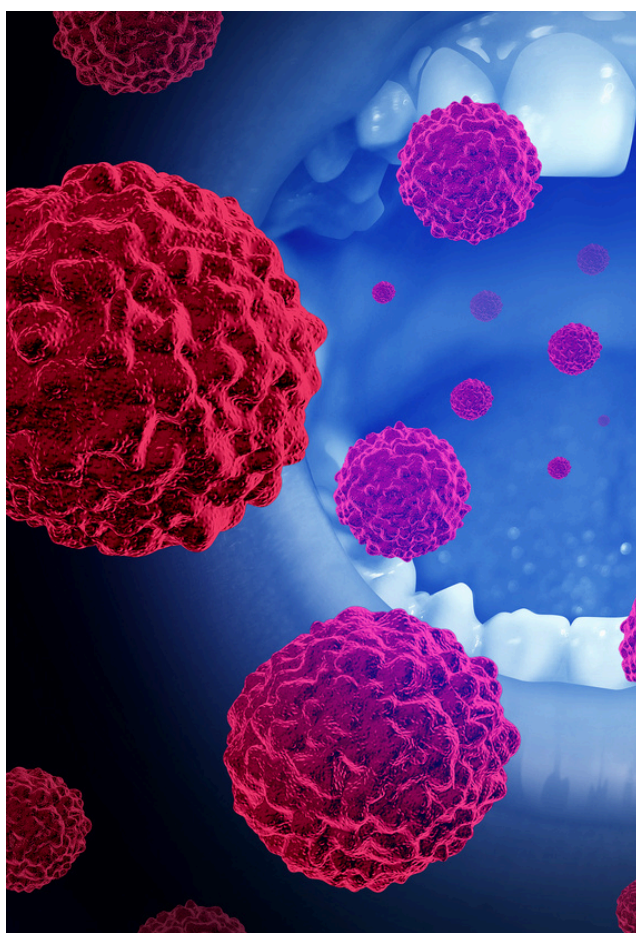
A Stanford-led study published in Science reveals how corn roots sense and grow toward water, a process called "hydropatterning," influenced by the plant hormones auxin and ethylene. Researchers found that tropical corn varieties are better at directing roots toward water, while many U.S.-bred varieties have lost this ability, potentially due to breeding for high yields. By analyzing 250 corn varieties, the team discovered that stronger water-seeking behavior is linked to deeper root systems, offering insights for developing drought-resilient crops.



## Climate Wake-Up Call: Rising Temperatures Demand Urgent Action Across Industries

***Energy companies can adopt renewable technologies to cut emissions and enhance sustainability, while agriculture and infrastructure sectors can implement climate-resilient practices to protect resources and ensure long-term stability. These strategies help reduce operational risks and drive sustainable growth.***

A new international study, led by Professor Jackie Dawson from the University of Ottawa, warns that current global commitments to reduce greenhouse gas emissions are insufficient, risking a 2.7°C temperature rise. The research highlights severe impacts, including Arctic ice loss, disrupted marine ecosystems, and heightened vulnerabilities for Indigenous communities. Published findings stress the need for stronger climate action to avoid extreme ecological and societal disruptions, urging nations to reassess their Paris Agreement pledges.



## Tiny Messengers, Big Impact: Exosome Metabolites Revolutionize Cancer Care

***The pharmaceutical sector can leverage these findings to design targeted drugs that block cancer-specific metabolic pathways, enhancing treatment effectiveness and minimizing side effects, while the biotechnology and diagnostics industries can develop innovative, non-invasive exosome-based screening tools for early cancer detection, filling urgent diagnostic needs.***

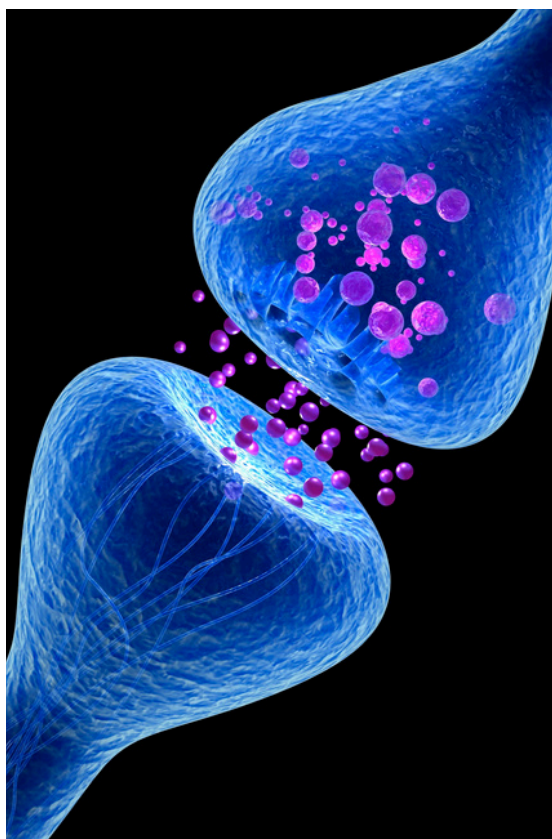
INST Mohali researchers have identified common metabolites in exosomes from aggressive cancers like pancreatic, lung, and glioma. Using advanced imaging and mass spectrometry, they found these metabolites could serve as universal biomarkers for early, non-invasive cancer detection. This breakthrough enhances understanding of tumor microenvironments and metabolic pathways, paving the way for targeted therapies and personalized medicine..



## Smart Drug Delivery: A New Approach to Treating Rheumatoid Arthritis

***This innovation benefits the pharmaceutical, biotechnology, and healthcare industries. Pharmaceutical companies can develop precision-based RA treatments with fewer side effects, while biotech firms can apply this system to other inflammatory diseases like synovitis and inflammatory bowel disease.***

Researchers at the Institute of Nano Science and Technology (INST), Mohali, have developed an advanced self-actuating drug delivery system to improve rheumatoid arthritis (RA) treatment. This system uses polymer-lipid hybrid microspheres loaded with methotrexate, a widely used RA drug, designed to release medication only when triggered by inflammatory enzymes (MMP-2 and MMP-9) during RA flare-ups. In animal studies, the system effectively reduced joint swelling, inflammation, and cartilage damage while promoting joint repair. Published in *Biomaterial Advances*, this targeted approach enhances drug retention in affected joints, reducing side effects and improving treatment efficiency compared to conventional RA therapies.

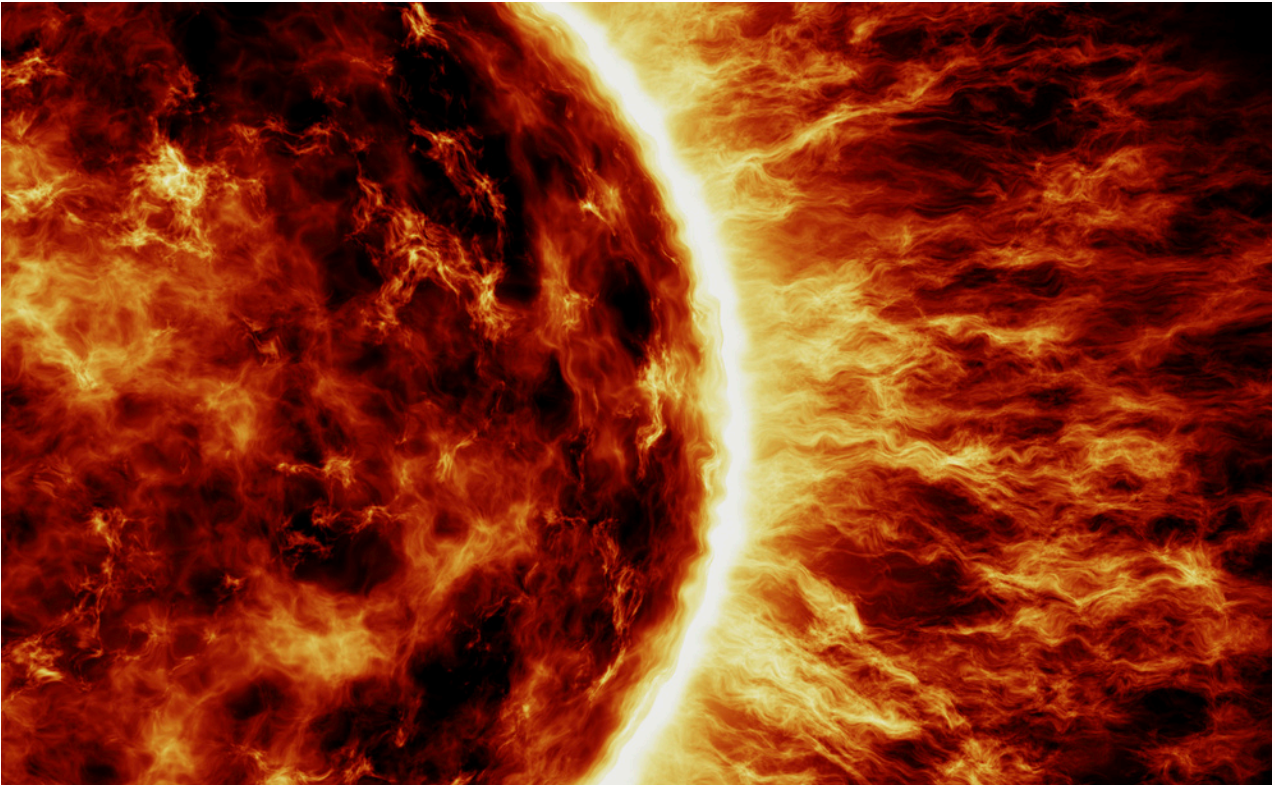


## Nature-Inspired Computing: Hybrid Materials Mimic Brain Synapses for Smarter AI

***This innovation benefits AI, robotics, and data processing industries by enabling faster, energy-efficient machine learning, adaptive robotics, and real-time data processing. These advancements enhance computing efficiency, intelligent automation, and power optimization across various applications.***

Scientists from S. N. Bose National Centre for Basic Sciences (SNBNCBS) and NITTTR have developed a hybrid material called AgCN, combining mesoporous graphitic carbon nitride with silver nanoparticles, to create a biomimetic system that mimics biological synapses. This innovation enables memristor devices to replicate synaptic functions, such as learning and pattern recognition, with high accuracy and energy efficiency. Published in *Advanced Functional Materials*, the technology demonstrates real-time applications like Morse Code detection and associative learning, paving the way for advanced neuromorphic computing systems.





## Sun's Dark Spots Unlocked: New Clues for Space Weather and Rainfall

***This research helps satellite operators mitigate space weather disruptions, ensuring uninterrupted communication and navigation services. Agriculture industries can optimize crop planning with improved monsoon forecasts, while space technology firms can design more resilient spacecraft to withstand solar wind effects.***

Astronomers at the Indian Institute of Astrophysics (IIA) have precisely mapped the thermal and magnetic field structures of solar coronal holes, which play a crucial role in space weather and the Indian monsoon. By analyzing eight years of data from the Solar and Heliospheric Observatory (SOHO), they discovered that coronal holes have a consistent temperature across latitudes but exhibit increasing magnetic field strength from the equator to the poles. These findings, published in *Astronomy and Astrophysics*, provide a deeper understanding of how solar activity influences geomagnetic storms and monsoon patterns, offering valuable insights for predicting space weather and climate variability.

*Thank you for reading!*

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