SINGAPORE UNIVERSITY OF TECHNOLOGY AND DESIGN

Weekly Discovery

We SHARE to inspire and ignite ideas!

17 Jul – 21 Jul 2023

AI

How An "AI-tocracy" Emerges

"Lasers at ~900nm have been of vital importance in various fields, including material processing, underwater communications, and strong-field physics. Although Nd3+ -doped materials have been employed for the ~900nm laser, the ~900nm emission is in strong competition with the often more dominating ~1060nm emission, which strongly limits the output power and applications. This paper proposes a direct coordination engineering approach, which introduces halogen to the nearest coordination of Nd3+ in glass for increasing the bond covalency, leading to stronger emissions at ~900nm than at ~1060nm. Iodide-incorporated Nd3+ -doped silica fibres show prevailing ~900nm emission rarely observed in Nd3+ -doped materials. Using the created fibres, a power (113.5 W) 50 times higher than the current record is accomplished based on an all-fibre structure. Our approach holds the potential for regulating the spectroscopic properties of other rare-earth-doped laser materials."

Source: MIT (13 Jul 2023)

AI

Using AI to Save Species from Extinction Cascades

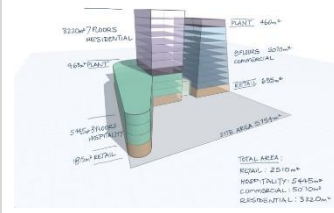
"The Flinders team's new research found that machine learning techniques can use a species' traits to predict predator-prey interactions accurately for birds and mammals. By identifying species that interact, machine learning can then help to predict and hopefully avoid extinctions before they happen.

The algorithm learns how traits are related to species interactions from information on which species interact, which species don't interact, and the traits of the species involved. This type of AI can then be provided with a list of species and traits to predict which of the species in the new list interact."

Source: Flinders (12 Jul 2023)

ARCHITECTURE

Five Ways to Revolutionise the Exploration, Design, and Creation of Buildings

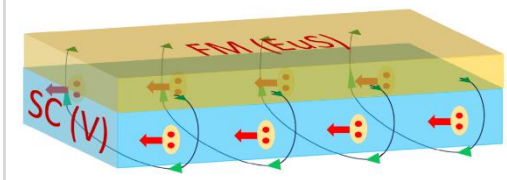


"Architecture encompasses a comprehensive design process that incorporates various steps and considerations for transforming abstract ideas into well-designed and functional projects. While specific approaches may vary, this dynamic and iterative process involves understanding the requirements, goals, and constraints of each case, followed by a conceptual design and detailed development of the spatial organisation, relationships, and aesthetic aspects. It concludes with a construction and post-occupancy evaluation. Creativity, collaboration, problem-solving, and previous site analysis guide the creation of functional and aesthetically pleasing designs. "

Source: ArchDaily (14 Jul 2023)

DIODE DESIGN

A More Efficient Superconducting Diode

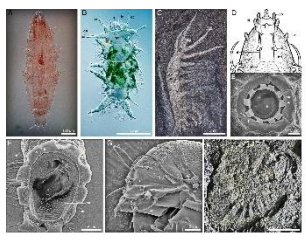


"Semiconductor diodes conduct current in one direction but not the other, giving them myriad applications in electronics. Their one-way property is made possible by a difference in the conducting behaviour of the two types of charge carriers—electrons and holes. Superconducting diodes could also be useful in sensors and other devices. But because supercurrents have just one type of carrier—electrons in so-called Cooper pairs—realising a superconducting diode is more difficult. In 2020 researchers demonstrated a diode effect in a superconducting device made from a layered material that required precise stacking, strong spin–orbit coupling, and a unique form of Cooper pairing [1]. Now Jagadeesh Moodera from the Massachusetts Institute of Technology and collaborators have made a superconducting diode that is more effective, simpler in design, and independent of esoteric electronic effects [2]."

Source: APS (13 Jul 2023)

EVOLUTION

Cambrian Lobopodians Shed Light on The Origin of The Tardigrade Body Plan

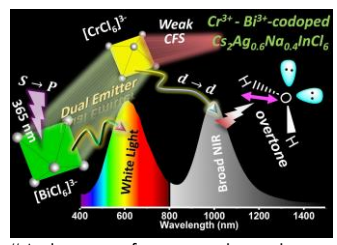


"Panarthropoda, the most speciose animal group, consists of three phyla (Euarthropoda, Onychophora, and Tardigrada), all of which are considered to have originated from Cambrian lobopodians. Numerous investigations of the evolutionary origin of euarthropods and onychophorans have been conducted, but the origin of tardigrades (water bears) remains largely underexplored. Here, we present an integrative morphological comparison between tardigrades and lobopodians with a phylogeny of panarthropods including lobopodians and major tardigrade lineages. The results provide insights into how tardigrades evolved their current morphology from the Cambrian lobopodian bodyplan."

Source: PNAS (3 Jul 2023)

FOOD

Detecting Spoiled Food with LEDs



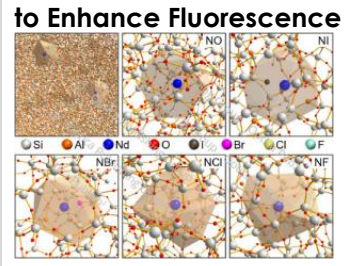
"A team of researchers has developed new LEDs which emit light simultaneously in two different wavelength ranges, for a simpler and more comprehensive way to monitor the freshness of fruit and vegetables. As the team write in the journal Angewandte Chemie, modifying the LEDs with perovskite materials causes them to emit in both the near-infrared range and the visible range, a significant development in the contact-free monitoring of food.

Perovskite crystals are able to capture and convert light. Being simple to produce and highly efficient, perovskites are already used in solar cells but are also being intensively researched for suitability in other technologies. Angshuman Nag and his team at the Indian Institute of Science Education and Research (IISER) in Pune, India, are now proposing a perovskite application in LED technology that could simplify the quality control of fresh fruit and vegetables."

Source: WILEY (13 Jul 2023)

LASER MATERIALS

High-Power Lasing At ~900 nm in Nd3+-Doped Fibre: A Direct Coordination Engineering Approach to Enhance Fluorescence



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Source: Optica (12 Jul 2023)

MATERIALS

Fungi Blaze A Trail to Fireproof Cladding

"RMIT scientists have shown it's possible to grow fungi in thin sheets that could be used for fire-retardant cladding or even a new kind of fungal fashion.

Mycelium, an incredible network of fungal strands that can thrive on organic waste and in darkness, could be a basis for sustainable fireproofing. RMIT researchers are chemically manipulating its composition to harness its fire-retardant properties.

Associate Professor Tien Huynh, an expert in biotechnology and mycology, said they've shown that mycelium can be grown from renewable organic waste."

Source: RMIT (30 June 2023)

MINING

Deep-Sea Mining Could Soon Be Approved — How Bad Is It?

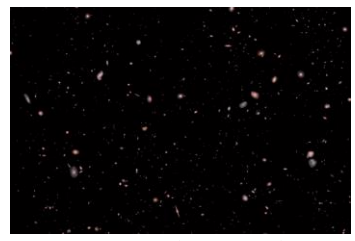
"Commercial mining of the sea floor could soon get the green light. The International Seabed Authority (ISA), a body associated with the United Nations that oversees deep-sea mining in international waters, is now meeting in Kingston, Jamaica, where it could decide whether companies can begin excavating the sea floor for minerals and metals such as cobalt, nickel and sulphides.

Proponents say that this move could help with meeting the growing demand for rare-earth metals used in batteries both for electric cars and for storing renewable energy, aiding the shift to a low-carbon economy. However, research hints that the potential ecological impacts of deep-sea mining are larger than previously thought. Nature explores just how bad deep-sea mining could be."

Source: Nature (14 Jul 2023)

NATURAL SCIENCE

NASA's Deepest 3D Fly-through of the Universe

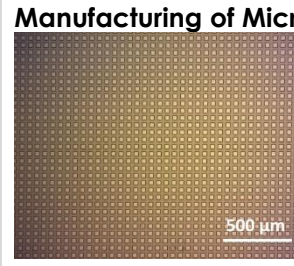


"It's hard to believe, but it was only 100 years ago—back in 1923—that humanity first realised that the Milky Way galaxy didn't encompass the entire Universe. That key discovery was made by Edwin Hubble, who, while observing what was then known as the Great Nebula in Andromeda, recognised that a periodic light "flare" he was seeing wasn't a nova as he originally thought, but was rather a variable star located much, much farther away than any of the Milky Way's stars. It was the first slam-dunk evidence that these spiral (and elliptical) nebulae, observed for centuries, were actually galaxies all unto themselves, or as they were called at the time, "island universes.""

Source: JSTOR (13 Jul 2023)

OPTICS

Researchers Develop Approach That Can Enable Inexpensive Mass Manufacturing of Micro-LED Displays



"Many scholars, analysts, and other observers have suggested that resistance to innovation is an Achilles' heel of authoritarian regimes. Such governments can fail to keep up with technological changes that help their opponents; they may also, by stifling rights, inhibit innovative economic activity and weaken the long-term condition of the country.

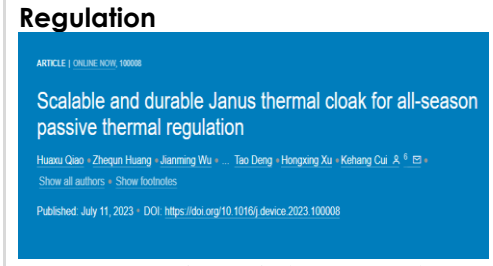
But a new study co-led by an MIT professor suggests something quite different. In China, the research finds, the government has increasingly deployed AI-driven facial-recognition technology to suppress dissent; has been successful at limiting protest; and in the process, has spurred the development of better AI-based facial-recognition tools and other forms of software.

"What we found is that in regions of China where there is more unrest, which leads to greater government procurement of facial-recognition AI, subsequently, by local government units such as municipal police departments," says MIT economist Martin Beraja, who is co-author of a new paper detailing the findings..."

Source: OPTICA (13 Jul 2023)

THERMAL REGULATION

Scalable And Durable Janus Thermal Cloak for All-Season Passive Thermal Regulation



"Thermal comfort of indoor environments accounts for 20% of the total world energy consumption. Thermal management of outdoor objects, such as vehicles, energy storage stations, and spacecraft, is vital for their serviceability and requires heavy energy load. The high energy costs and future carbon-neutral scenario pose urgent demands for low-cost, reliable, energy-efficient thermal-regulation technologies.

We realise a Janus thermal cloak (JTC) for all-season, passive temperature regulation through radiative cooling and photon recycling. The JTC is readily scalable-manufactured, truly passive, and does not involve phase change or moving parts. The JTC is also reliable in harsh thermal, cryogenic, vibration, and corrosive environments. Our field tests on electric vehicles show that the JTC achieves sub-ambient cooling by 8.0°C in summer daytime and supra-ambient warming by 6.8°C in winter nights. The JTC is suitable for use in buildings, vehicles, and extraterrestrial environments. "

Source: CELL (11 Jul 2023)