SINGAPORE UNIVERSITY OF TECHNOLOGY AND DESIGN

Weekly Discovery

We SHARE to inspire and ignite ideas!

10 Jul – 14 Jul 2023

AI

Dangerous Chatbots: Prof. Stephen Gilbert Calls for AI Chatbots To Be Approved as Medical Devices / New Paper in Nature Medicine

"LLM-based generative chat tools, such as ChatGPT or Google's MedPaLM have great medical potential, but there are inherent risks associated with their unregulated use in healthcare. The new Nature Medicine paper by Prof. Stephen Gilbert, et. al. addresses one of the most pressing international issues of our time: How to regulate Large Language Models (LLMs) in general and specifically in health."

Source: TU (30 Jun 2023)

AI

Unravelling the Humanity in Metacognitive Ability: Distinguishing Human Metalearning from AI

"Quantum geometry in condensed matter physics has two components: the real part quantum metric and the imaginary part Berry curvature. Whereas the effects of Berry curvature have been observed through phenomena such as the quantum Hall effect in 2D electron gases and the anomalous Hall effect (AHE) in ferromagnets, quantum metric has rarely been explored. Here, we report a nonlinear Hall effect induced by quantum metric dipole by interfacing even-layered MnBi2Te4 with black phosphorus. The quantum metric nonlinear Hall effect switches direction upon reversing the AFM spins and exhibits distinct scaling that is independent of the scattering time. Our results open the door to discovering quantum metric responses predicted theoretically and pave the way for applications that bridge nonlinear electronics with AFM spintronics. "

Source: Tsukuba (8 Jul 2023)

AI

AI finds a way to people's hearts (literally!)

"Osaka, Japan - AI (artificial intelligence) may sound like a cold robotic system, but Osaka Metropolitan University scientists have shown that it can deliver heartwarming—or more to the point, "heart-warning"—support. They unveiled an innovative use of AI that classifies cardiac functions and pinpoints valvular heart disease with unprecedented accuracy, demonstrating continued progress in merging the fields of medicine and technology to advance patient care. The results will be published in The Lancet Digital Health."

Source: OMU (7 Jul 2023)

EVOLUTION

Oldest Genetic Data from A Human Relative Found In 2-Million-Year-Old Teeth

"Hominins — humans and their ancient relatives — emerged in Africa some seven million years ago. Now researchers have gleaned genetic information from an African hominin that lived two million years ago, the oldest such data yet recovered.

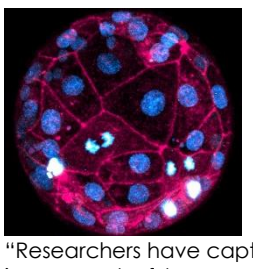
The protein sequences, described in a preprint posted on the bioRxiv server on 3 July1, come from several Paranthropus robustus tooth fossils found in a South African cave.

These genetic data are the oldest that have been collected from any hominin, pushing back the genetic record to times and places previously unthinkable, scientists say."

Source: Nature (10 Jul 2023)

IMAGING

Developing Human Embryos Imaged at Highest-Ever Resolution



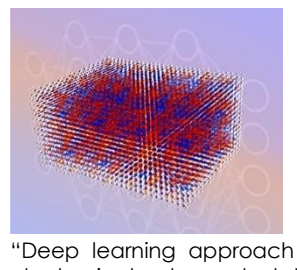
"Researchers have captured the most-detailed images yet of human embryos developing in real time, using two common laboratory tools — fluorescent dyes and laser microscopes.

The technique, described in Cell on 5 July1, allows researchers to study crucial events in the first few days of development without genetically altering the embryos, which has previously restricted the use of some imaging techniques in human embryos, owing to ethical concerns."

Source: Nature (6 Jul 2023)

MATERIALS

Machine learning takes materials modelling into new era



"Deep learning approach enables accurate electronic structure calculations at large scales.

The arrangement of electrons in matter, known as the electronic structure, plays a crucial role in fundamental but also applied research such as drug design and energy storage. However, the lack of a simulation technique that offers both high fidelity and scalability across different time and length scales has long been a roadblock for the progress of these technologies. Researchers from the Centre for Advanced Systems Understanding (CASUS) at the Helmholtz-Zentrum Dresden-Rossendorf (HZDR) in Görlitz, Germany, and Sandia National Laboratories in Albuquerque, New Mexico, USA, have now pioneered a machine learning-based simulation method (npj Computational Materials, DOI: 10.1038/s41524-023-01070-z) that supersedes traditional electronic structure simulation techniques. Their Materials Learning Algorithms (MALA) software stack enables access to previously unattainable length scales."

Source: HZDR (7 Jul 2023)

MATERIAL

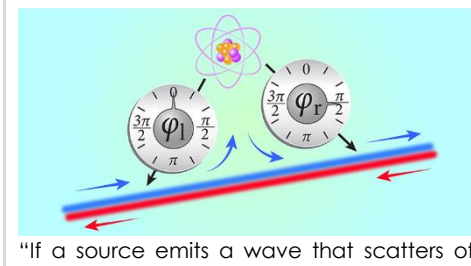
Mapping The Future of Hemp Architecture and Construction Materials: Revolutionising the Industry

"In recent years, the spotlight on sustainable, eco-friendly, and low-carbon materials has intensified across the architecture industry. Amid this interest, a renaissance of hemp architecture is gradually gaining momentum on a global scale. Hemp-based materials have emerged as a favourable alternative to traditional industrialised materials, presenting a multitude of benefits that could revolutionise the construction industry. Despite its vast promise, several hurdles obstruct the widespread adoption of hemp, inhibiting its transformative potential in the construction industry. "

Source: ArchDaily (10 Jul 2023)

QUANTUM PHYSICS

Artificial Atoms Go Chiral

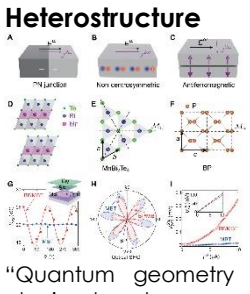


"If a source emits a wave that scatters off an object and is then measured by a detector, the principle of reciprocity states that the measured signal will be unchanged if the source and detector switch places. This symmetry is a prevalent feature in all physical systems, but for certain applications it constitutes an obstacle. For example, to create an isolator—a gadget that allows signals to pass in one direction but not in the other—reciprocity must be broken. Such nonreciprocal devices—ones defined by preferential direction or "chirality" in their emission or absorption—are valuable in many fields."

Source: Physics (26 Jun 2023)

QUANTUM PHYSICS

Quantum Metric Nonlinear Hall Effect in A Topological Antiferromagnetic Heterostructure



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Source: Science (15 Jun 2023)

SARS-CoV-2

COVID-19 Digital Contact Tracing Worked — Heed the Lessons for Future Pandemics

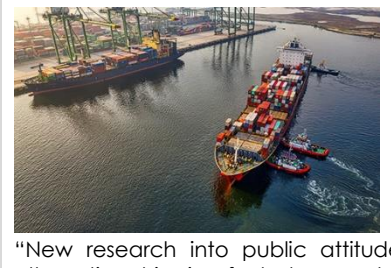
"During the first year of the COVID-19 pandemic, around 50 countries deployed digital contact tracing. When someone tested positive for SARS-CoV-2, anyone who had been in close proximity to that person (usually for 15 minutes or more) would be notified as long as both individuals had installed the contact-tracing app on their devices.

Digital contact tracing received much media attention, and much criticism, in that first year. Many worried that the technology provided a way for governments and technology companies to have even more control over people's lives than they already do. Others dismissed the apps as a failure, after public-health authorities hit problems in deploying them."

Source: Nature (3 Jul 2023)

SUSTAINABILITY

Public support hydrogen and biofuels to decarbonise global shipping



"New research into public attitudes towards alternative shipping fuels shows public backing for biofuel and hydrogen.

The study involving the University of Southampton also found that nuclear was preferred to the heavy fuel oil (HFO) currently used in the global shipping industry, although both were perceived negatively. Ammonia had the least public support.

Global shipping is responsible for 80 to 90 per cent of the world trade and accounts for around 3 per cent of global greenhouse gas (GHG) emissions. In 2021, 230 industry leaders pledged to achieve net-zero GHG emissions by 2050. "

Source: Southampton (6 Jul 2023)

WASTE

The looming 840,000 tonne waste problem that isn't single-use plastics

"It's estimated that by 2030 carbon and glass fibre composites (CFRP), materials commonly used in wind turbine blades, hydrogen tanks, airplanes, yachts, construction, and car manufacturing, will be a key waste stream worldwide.

The annual accumulation of CFRP waste from aircraft and wind turbine industries alone is projected to reach 840,300 tonnes by 2050 – the equivalent of 34 full stadiums – if suitable recycling methods are not adopted.

While recycling methods do exist, most of this waste currently goes to landfill or is incinerated. The production of "virgin" composites has further implications for the environment too, including resource depletion and high energy input during production."

Source: SYDNEY (3 Jul 2023)