SINGAPORE UNIVERSITY OF TECHNOLOGY AND DESIGN

Weekly Discovery

We SHARE to inspire and ignite ideas!

17 - 21 April 2023

ARCHITECTURE

Patio House / Garnier Arquitectos

"Casa Patio is in Puntarenas, on the Pacific coast of Costa Rica, in a luxury residential community in Playa Hermosa.

The project is developed within a 1924m2 property, surrounded by gardens, in the middle of the tropical nature that surrounds that community and the Pacific Ocean on the west side.

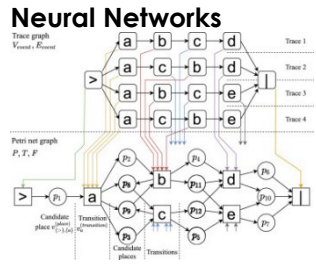
The land is characterised by being flat, having two slopes on its sides that divide the adjoining lots. In its two main ends, one entrance faces the public street, and another has a view of the sea.

The house is designed in 800m2, the intention of the design was to create a main block with private areas, the program of the social area was a transversal block to the main block, giving priority to the view, which is the sea."

Source: ArchDaily (16 April 2023)

GRAPH NEURAL NETWORKS

Supervised Learning of Process Discovery Techniques Using Graph Neural Networks



"In this paper, we explore the problem of supervised learning of a process discovery technique. We introduce a technique for training an ML-based model using graph convolutional neural networks, which translates a given input event log into a sound Petri net. We show that training this model on synthetically generated pairs of input logs and output models allows it to translate previously unseen synthetic and several real-life event logs into sound, arbitrarily structured models of comparable accuracy and simplicity as existing state of the art techniques in imperative mining. We analyse the limitations of the proposed technique and outline alleys for future work."

Source: ScienceDirect (8 April 2023)

IMPROVING CLASSROOM TEACHING

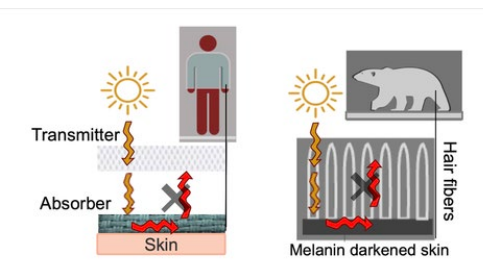
Emotions In Media Education: How Media Based Emotions Enrich Classroom Teaching and Learning

This article introduces an area of interdisciplinary research in the intersection of education science, media studies, communication studies and media psychology. The article views media as learning objects, teaching media, and learning tools in a socially networked environment, and examines the relationship between emotions and media in educational practice. The practical examples presented and theoretically analysed in this article also demonstrate how digital media in educational contexts draw on emotions to foster processes of reflection and action-oriented learning. Learners are activated by teaching and learning media which have a connection to their lifeworlds, and by active media work and working methods which are based on interactionist and constructivist theories. These may also contribute to the acquisition of wide-ranging competence experience and support learners' social relatedness and participation.

Source: ScienceDirect (7 April 2023)

MATERIALS

New Textile Unravels Warmth-Trapping Secrets of Polar Bear Fur



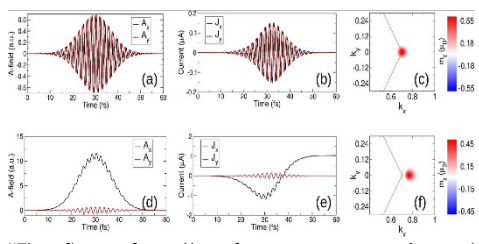
"Three engineers at the University of Massachusetts Amherst have invented a fabric that concludes the 80-year quest to make a synthetic textile modelled on polar bear fur. The results, published recently in the journal ACS Applied Materials and Interfaces, are already being developed into commercially available products.

Polar bears live in some of the harshest conditions on earth, shrugging off Arctic temperatures as low as -50 Fahrenheit. While the bears have many adaptations that allow them to thrive when the temperature plummets, since the 1940s scientists have focused on one in particular: their fur. How, the scientific community has asked, does a polar bear's fur keep them warm?"

Source: UMASS (14 April 2023)

OPTICS

Laser Light Hybrids Control Giant Currents at Ultrafast Times

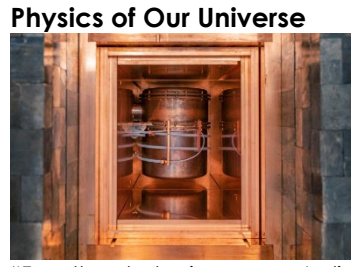


"The flow of matter, from macroscopic water currents to the microscopic flow of electric charge, underpins much of the infrastructure of modern times. In the search for breakthroughs in energy efficiency, data storage capacity, and processing speed, scientists search for ways in which to control the flow of quantum aspects of matter such as the "spin" of an electron – its magnetic moment – or its "valley state," a novel quantum aspect of matter found in many two-dimensional materials. A team of researchers at the Max Born Institute in Berlin have recently discovered a route to induce and control the flow of spin and valley currents at ultrafast times with specially designed laser pulses, offering a new perspective on the ongoing search for the next generation of information technologies."

Source: MBI (13 April 2023)

PHYSICS

IU Researchers' Part of Collaborative Project to Better Understand the Physics of Our Universe



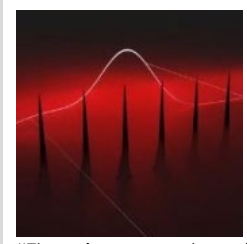
"For the last six years, Indiana University researchers and collaborators from around the world have sought to answer important questions about the most basic laws of physics that govern our universe. Their experiment, the Majorana Demonstrator, has helped to push the horizons on research concerning one of the fundamental building blocks of the universe: neutrinos.

The experiment's final report was published in Physical Review Letters in February."

Source: IU (7 April 2023)

QUANTUM CASCADE LASER

Short Pulses from A Gain-Switched Quantum Cascade Laser

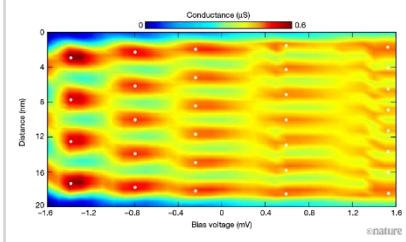


"The picosecond carrier dynamics observed in quantum cascade lasers (QCLs) poses a fundamental obstacle for the formation of intracavity pulses. On the other hand, the ultrafast gain response makes the QCL ideally suited for high frequency modulation of its pump current. In this work, we leverage this property and use short electrical excitations to generate 33 ps optical pulses with up to Watt level peak power. We ensure lasing on a single resonator mode via optical injection seeding. The resulting pulses are characterised in both time and frequency domains using an optical sampling method in combination with a spectrometer. We interpret the obtained results using laser rate equations. The results presented in this work open new pathways for the generation of highly tunable, high power mid-infrared pulses from a monolithic source."

Source: Optica (12 April 2023)

QUANTUM MATERIAL

Quantisation observed for 'heavy' electrons



"Quantum materials can host exotic phases of matter in which electrons form unusual collective states. Scientists have struggled to observe the quantisation that these electronic states are expected to show, but this phenomenon has now been detected in heavy states at the surface of a superconducting quantum material."

Source: Nature (14 April 2023)

ROBOTICS

It's All in The Wrist: Energy-Efficient Robot Hand Learns How Not to Drop the Ball

"Grasping objects of different sizes, shapes and textures is a problem that is easy for a human but challenging for a robot. Researchers from the University of Cambridge designed a soft, 3D-printed robotic hand that cannot independently move its fingers but can still conduct a range of complex movements.

The robot hand was trained to grasp different objects and was able to predict whether it would drop them by using the information provided by sensors placed on its 'skin.'

This type of passive movement makes the robot far easier to control and far more energy-efficient than robots with fully motorised fingers. The researchers say their adaptable design could be used in the development of low-cost robots that are capable of more natural movement and can learn to grasp a wide range of objects. The results are reported in the journal Advanced Intelligent Systems."

Source: CAMBRIDGE (12 April 2023)

SUSTAINABLE FOOD TECHNOLOGY

Sustainable Plant Protein: A Recent Overview of Sources, Extraction Techniques and Utilisation Ways

"In context to plant proteins, there are three main categories namely, leguminous proteins, cereal proteins, and oil seed proteins. Legumes play crucial role in the human diet as they contain essential amino acids, calories, minerals, and vitamins. Cereals are vital for human nutrition, but their protein quality is poor due to a lack of amino acid-lysine. Oilseed proteins can be used to provide good nutritive value and functional qualities to foods. Processing of plant proteins involves physico-chemical and thermal treatments that affect both the nutritional value and functional properties of the final product. With the advent of green chemistry, research is increasingly focusing on non-thermal green methods to improve extraction efficiency and minimise proteolysis during extraction. The present review focusses on the recent literature about the plant protein sources, isolation/extraction techniques and application of plant proteins in food sector."

Source: RSC (13 April 2023)

SUSTAINABLE FOOD TECHNOLOGY

Texas A&M Researchers Discover New Circuit Element

"Dr. H. Rusty Harris, associate professor in the Department of Electrical and Computer Engineering at Texas A&M University, has identified a new circuit element known as a meminductor.

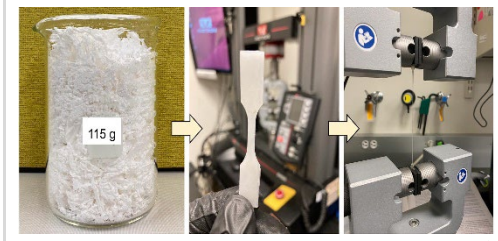
A circuit element is an electrical component used to help direct and control the flow of electricity through an electrical circuit. The classical three are known as the resistor, capacitor, and inductor. Two additional circuit elements, the memristor and the memcapacitor, were only discovered in the past 15 years. These newer circuit elements are known as the mem- versions of their classical counterparts, and their current and voltage properties are dependent on previous values of current or voltage in time, like a memory.

"Those two discoveries set the world a little bit on its head as far as electrical engineering," Harris said. "All of the sudden, we thought we had three, but now we found these two others. And so that led us to think, 'OK, there's got to be more then, but how do we understand what they are? How do we map all these things relative to each other?' And it turns out, there is a relationship between each of the resistors and its family and each of the capacitors and its family."

Source: TAMU (30 March 2023)

SUSTAINABILITY

Chemists Redesign Biological Phas, 'Dream' Biodegradable Plastics



"They've been called "dream" plastics: polyhydroxyalkanoates, or PHAs. Already the basis of a fledgling industry, they're a class of polymers naturally created by living microorganisms, or synthetically produced from biorenewable feedstocks. They're biodegradable in the ambient environment, including oceans and soil.

But there's a reason PHAs haven't taken off as a sustainable, environmentally benign alternative to traditional plastics. Crystalline PHAs are brittle, so not as durable, and convenient as conventional plastics. They cannot easily be melt-processed and recycled, making them expensive to produce.

Colorado State University polymer chemists led by Eugene Chen, University Distinguished Professor in the Department of Chemistry, have created a synthetic PHA platform that addresses each of these problems, paving the way for a future in which PHAs can take off in the marketplace as truly sustainable plastics."

Source: NATSCI (11 April 2023)