Making Engineering Studies Fun

Dialogue

By LONG Yun & BI Weizi

When a university course becomes more than just a requirement on a transcript, and it transforms into a pathway for students to improve skills, a launchpad for innovation, and a nationally recognized model of excellence, something extraordinary is happening in the classroom.

At the University of Nottingham, Ningbo, China (UNNC), British scientist Dr. Adam Rushworth has not only redefined how engineering is taught but is also pushing the boundaries of what's possible in additive manufacturing.

Redefining metal printing

Rushworth's journey into advanced manufacturing began with a practical challenge from an electrical engineering colleague: how to fabricate complex motor windings using multiple materials. Using copper for conductivity and insulation materials for safety, saw existing 3D metal printing methods struggle with such complexity. That sparked the development of a novel droplet- on- demand metal 3D printer.

Unlike conventional powder-bed fusion techniques like Selective Laser Melting (SLM), which use hazardous and costly metal powders, Rushworth's system relies on solid metal rods. These are melted into precise droplets and deposited layer by layer. "This is much less expensive and dangerous," he told *Science and Technology Daily*. "By having multiple printheads, we are also able to print more than one material at the same time." This capability opens doors for integrated components, such as motors with built- in windings and insulating layers without post-assembly.

Dr. Adam Rushworth. (COURTESY PHOTO)

The implications stretch across industries. From lightweight aerospace components to customized medical devices and even hobbyist applications, the technology democratizes access to metal printing. "The applications are limitless: aerospace, automotive systems, healthcare, hobbyists, small businesses and so on." By lowering cost and complexity, Rushworth's approach brings advanced manufacturing within reach of innovators beyond well-funded labs.

The power of hands-on learning

At the heart of Rushworth's teaching philosophy is a simple but powerful belief: real engineering happens with your hands. "Unless you actually build parts and systems by yourself, you don't appreciate the difficulty of manufacturing, assembling and testing," he said. His course is built on project- based learning, where students tackle large-scale engineering problems from concept to physical prototype.

He recalled his own shift from physics to engineering: "Most of the learning focused on abstract concepts and proofs, not concrete, hands- on problems." That experience shaped his approach. "Gaining a degree that focuses primarily on theory may be valuable but it doesn't equip you to solve real-world problems," said Rushworth. His classroom is intentionally immersive, visual and tactile. Content is delivered just in time, applied immediately, and assessed through doing.

"Having students work on a physical design project makes the module more rewarding and fun!" For many, the moment their creation finally works after iterations, failures and late nights mirrors the wonder Rushworth felt as a child, launching a homemade bottle rocket 30 meters into the air. "For many of the students, the testing session for their design work holds the same sense of wonder that my experiments in design and dynamics as a child held for me," he said.

Inspiring the next generation

Rushworth doesn't hide his love for science fiction. From *Star Trek replicators* to *The Three-Body Problem*, these stories aren't just entertainment for him. They are blueprints of possibility. "I mean my research is about 3D printers, robots and lasers. How much geekier can you get?" he said. He uses sci-fi as a teaching tool, showing clips from *Star Wars* and *Star Trek* to spark curiosity and challenge students to distinguish fiction from reality. "Those who this stuff really appeals to will be drawn to the classics as much as the modern." What matters is cultivating a mindset that embraces failure as part of progress.

To students who feel daunted by engineering, his advice is direct: "Try. Fail. Try again. Fail again. Keep trying and failing. That is the only way to build experience and succeed in design and engineering." He speaks from experience academically and personally, "I failed many times but I have always had the support I needed to keep trying."

For Rushworth, moving from the UK to UNNC was a leap of faith, one guided by both professional opportunity and personal conviction. The university's balance of autonomy and collaboration allows him to innovate freely in both research and teaching. "The teaching load is heavy, but I have been given a lot of freedom to shape my modules."

For Rushworth, the goal isn't just successful projects. "The end goal is reaching your potential, developing skills and becoming a better engineer, designer, researcher, or person than you were when you started." In classrooms and labs across Ningbo, that vision is already taking shape, one droplet, one design, one determined student at a time.

JUNO's Breakthrough in Precision Measurement of Solar Neutrinos

Science Outreach

By Staff Reporters

Buried 700 meters beneath rolling hills in Guangdong province, southern China, the Jiangmen Underground Neutrino Observatory (JUNO) has officially entered operation and released its first scientific results, marking a major step forward in global neutrino research.

On November 19, the Institute of High Energy Physics (IHEP) under the Chinese Academy of Sciences (CAS) held a press conference at the facility to announce the release of its first scientific results. Using data collected over 59 days since the detector began operations, the JUNO collaboration has measured two key parameters governing solar neutrino oscillations, improving measurement precision by 1.5 to 1.8 times compared to the previous best results.

As the world's first completed next-generation neutrino experiment of ultra-large scale and ultra-high precision, JUNO aims to answer some of the most profound questions in modern physics.

Probing the universe with 'ghost particles'

Neutrinos are often called "ghost particles" because they can pass effortlessly through Earth and human bodies without leaving a trace.

"This near- invisibility makes neutrinos perfect cosmic messengers, carrying ancient information about the birth and evolution of the universe," said Wang Yifang, spokesperson for the JUNO collaboration and CAS member.

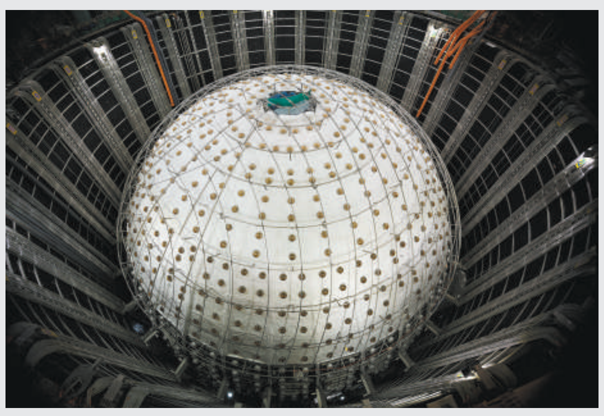
According to Wang, JUNO is a dedicated large-scale scientific facility built specifically to study these elusive particles. There are three known types of neutrinos: electron, muon and tau neutrinos.

"JUNO's core goal is to determine their mass ordering — figuring out which one is the heaviest and which is the lightest," said Cao Jun, director of IHEP. "This is one of the most fundamental open questions in neutrino physics today."

In addition to resolving the mass hierarchy, JUNO will make high-precision measurements of neutrino oscillation parameters and conduct multi- source studies of solar neutrinos, geoneutrinos from Earth's interior, supernova neutrinos, atmospheric neutrinos and even search for proton decay.

"Through these efforts, JUNO will uncover secrets about the interiors of stars and planets and hunt for signals from the early universe," Cao said. "We believe this research will greatly advance our understanding of neutrinos and may reveal new physics beyond current theoretical frameworks."

Why neutrinos matter to everyone



The photo shows the central detector of the JUNO in Jiangmen, south China's Guangdong province. (PHOTO: XINHUA)

Though invisible and intangible, neutrinos are deeply connected to human existence. "The most direct link between neutrinos and us goes back to the very beginning of everything. They determined whether we could exist at all," Wang explained.

In the immediate aftermath of the Big Bang, tiny "density fluctuations" filled space. These served as the original seeds for all future structures: galaxies, stars, planets and life itself. If neutrinos had zero mass, they would have traveled at the speed of light and erased those primordial seeds before gravity could amplify them.

"It is precisely because neutrinos have a tiny but non- zero mass that they slowed down enough to let those early fluctuations survive and grow," Wang said. "Without that small mass, there would be no galaxies, no Sun, no Earth and no humans."

Cao emphasized that while such research may not yield immediate applications, its long- term value is immeasurable.

"Studying neutrinos is pure exploration of nature's laws. It may not seem useful right away, but history shows that foundational discoveries often lead to unforeseen breakthroughs. When electricity was first discovered, no one knew it would power the modern world," he said. "That is the essence of basic research: We seek to understand the world first, and the seeds of future change are often hidden in that understanding."

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My China Story

Smart Traffic Solutions from China for West Africa

By LONG Yun & BI Weizi

Ten years ago, Adje Jérémie Alagbé, a young engineer from Benin, arrived at Sichuan in southwest China with just a suitcase and a strong determination to learn Mandarin.

Today, as an assistant professor at Beihang University's Smart Aviation Center, Dr Alagbé works at the crossroads of human behavior, intelligent transportation systems, and artificial intelligence. His research, though rooted in Chinese cities, is guided by a long-term mission: to bring safer, smarter mobility to West Africa.

"I didn't just come to China to study traffic. I came to learn how a country can turn data into safety, and strangers into friends," he told *Science and Technology Daily* in a recent interview.

Alagbé grew up in Cotonou on the south coast of Benin, where the roads are far less crowded than in Beijing. He recalls watching accidents happen not because of the traffic volume, but because of confusion and a general lack of coordinated infrastructure.

That experience led him to Zhejiang University in east China, where he completed a master's degree in traffic information engineering and control in 2019 and a PhD in highway and transportation engineering in 2024.

During his doctoral work, he focused on a specific challenge in urban intersections: variable lane assignment.

These lanes change direction based on traffic demand, sometimes allowing left turns, other times straight movement to improve flow during peak hours. While efficient in theory, they often confuse drivers unfamiliar with the system.

Using eye-tracking devices and naturalistic driving studies, Alagbé found that many drivers hesitate when approaching these lanes. Some make last-second decisions. Others enter incorrectly and stop mid- intersection, blocking the traffic. The result is not only reduced efficiency but also increased crash risk.

"This isn't just a traffic engineering problem," he explains. "It's about how people process information under pressure. If a driver cannot understand what a lane means within a second or two, the system has already failed."

To address this, Alagbé turned to machine learning with a focus on transparency. Instead of using black-box models that offer predictions without explanations, he builds systems that show why a certain action is recommended.

For example, if a vehicle detects a driver is about to enter a variable lane incorrectly, it can provide a clear, timely message: "This lane is currently for going straight only." Such clarity, he says, helps drivers trust and act on intelligent warnings.

Despite his growing academic profile, Alagbé remains focused on practical impact. "Every model I develop, every dataset I analyze, is shaped by the question: Will this work someday in Benin?"

He knows that the advanced sensors and connected infrastructure common in Chinese cities do not yet exist in his home country. "I have stayed in China because I still have much to learn and much to contribute here," he said. "But my goal has always been to take what I've gained and apply it where it's needed most."

Language has played a major role in his journey. After spending two years studying Mandarin before starting his master's program, he now speaks fluently enough to collaborate with local engineers, give lectures in Chinese, and even share jokes with colleagues.

"If I had gone back right after my PhD, all that effort might have gone to waste," he laughs. "Here, I use it every day. It connects me to people in a way technical papers never could."

He also speaks warmly of the personal connections he has formed over the years. In Sichuan, strangers would stop him on the street to practice their English or teach him local phrases. "That kind of warmth made me feel welcome long before I understood the language fully," he says.

As China continues to open its doors to international researchers, Alagbé appreciates the support he has received from lab access to housing assistance. At the same time, he understands the need for caution. "Some data must remain protected. That's about responsibility."

Looking ahead, he hopes to build bridges between Chinese innovation and African needs. "Transportation is universal. Everyone wants to move safely and efficiently. But solutions must fit local contexts."

One day, he dreams of helping design a smart intersection in Cotonou, one informed by experience from China but built for Beninese drivers.

Oysters Shield Marine Engineering Projects

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They developed a specific oyster inducer based on the adhesive properties of dominant oyster species in specific sea areas and their environmental features. Coupled with biological concrete, cement-based paint and oyster adhesive bases, this inducer quickly attracted a large number of oysters.

The team also developed a comfortable home for oyster larvae to grow in by controlling the penetration rate of materials, innovatively created from industrial and agricultural solid waste like fly ash and slag.

This approach transformed negative defense into active defense by sessile organisms.

Ecological added value

This new technology, recognized by experts as groundbreaking, provides ecological added value besides engineering work protection.

The biological concrete, cement-based paint and adhesive bases have double advantage: They are both highly efficient in erosion prevention and ecological restoration. Especially, the cement-based paint doesn't emit any volatile organic compound, realizing the leap from low carbon to negative carbon.

In addition, the filter-feeding function of oysters can purify the water, enhance fishery resources and boost biodiversity. In the long term, it also has the potential for net carbon sequestration.

According to Lv, the oyster- like reefs formed on the surface of engineering works can filter approximately 100 tonnes of seawater per square meter every day, significantly reducing suspended particulate matter and eutrophication levels in the water body.

The three-dimensional structure of these reefs provides an excellent habitat for marine organisms. Not only are they fish spawning grounds and crab shelters, they can also reduce wave energy and coastline erosion.

Incorporating anti- erosion for marine engineering projects, ecological restoration and aquaculture, this technology provides a solution for the development of green marine technologies.