Asst. Prof. Hsiao-Tsu Wang and Students' International Collaboration on Key Synchrotron Technology Featured in Nature

Campus focus

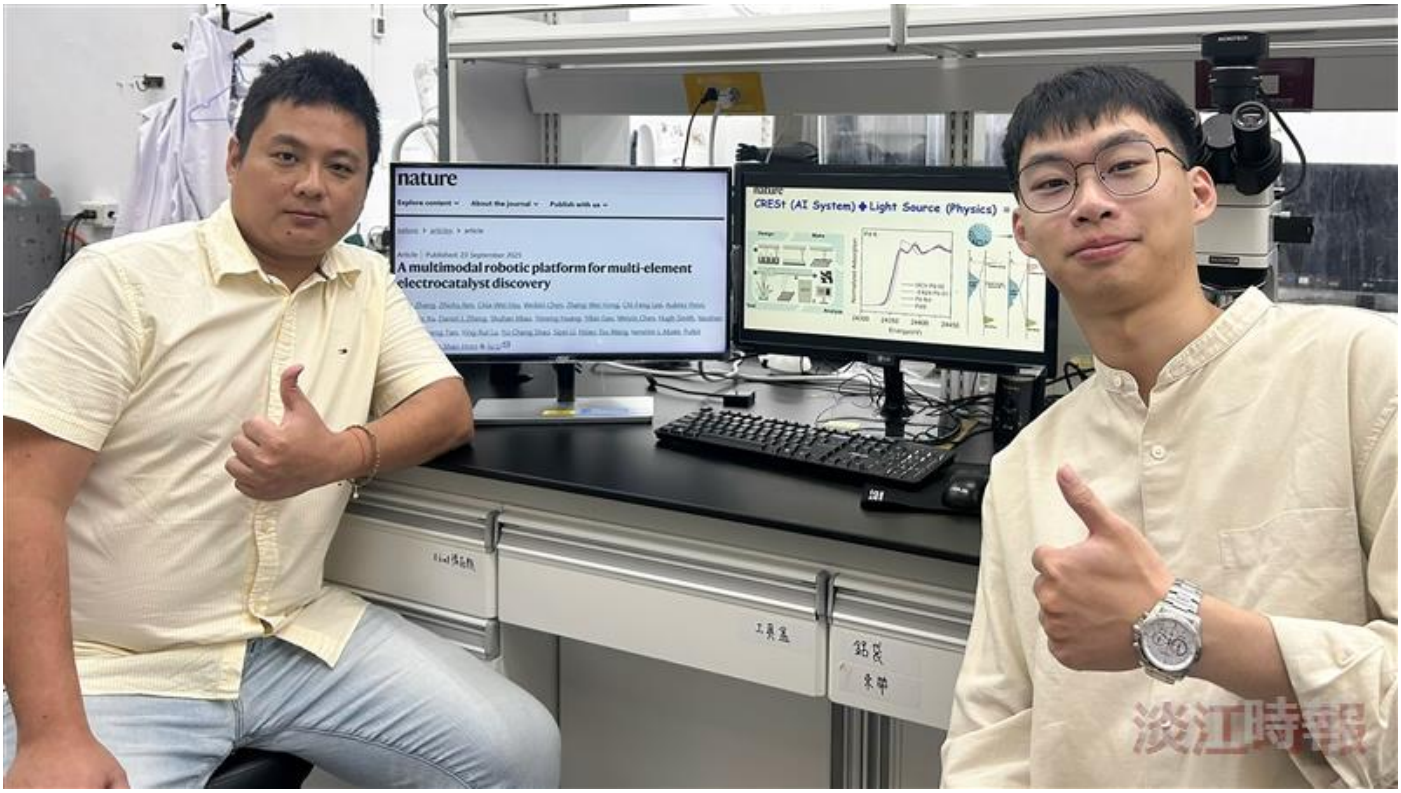
Assistant Professor Hsiang-Tsu Wang from the Department of Physics recently led first-year master's student Chi-Feng Li in a collaborative research project with Professor Jun Li from the Department of Materials Science at the Massachusetts Institute of Technology (MIT). Their latest findings were published in the world's top scientific journal, Nature, demonstrating how AI can be integrated to explore material physics mechanisms. Supported by Tamkang University's international collaboration program and advanced synchrotron radiation technologies, the study highlights the emerging value of AI in modern physics. Regarding the publication of the research in a top-tier journal, Wang expressed his gratitude not only to his research team but also to the university for providing partial funding support during the early stages of the project, which enabled him to successfully initiate international collaboration with MIT.

He explained that the research team developed an AI-powered scientific co-pilot platform called CRESt, which integrates deep learning, big data, and automated experimental robotics to efficiently predict and screen high-entropy alloy catalytic materials. Within just three months, the team tested more than 900 chemical compositions and conducted 3,500 electrochemical experiments, successfully identifying an 8-element high-entropy alloy catalyst with energy efficiency 9 times higher than traditional Pd-based materials. This achievement significantly reduces the time and manpower required for designing new energy materials.

Beyond AI-driven data analysis, synchrotron radiation technology played a key role in the study. Using synchrotron X-ray techniques, researchers were able to observe the stability and performance of catalytic materials in real time during reactions. Wang emphasized that such atomic- and electronic-level observations are impossible in conventional experiments

and that synchrotron radiation has now become a leading force in advancing the deeper understanding and design of materials science. “Our research previously faced limitations in understanding microscopic reaction mechanisms,” said Wang. “Collaboration with Tamkang Physics helped resolve this challenge, showcasing the maturity of our synchrotron technology and offering young researchers in fundamental physics and materials science a perfect example of how to ‘see the invisible world.’ ”

Department Chair Prof. Cheng-Hao Chuang remarked that the Department of Physics has long been dedicated to cultivating talents with both interdisciplinary expertise and a global perspective. This Nature publication demonstrates how AI can be seamlessly applied to energy materials and synchrotron radiation research. Tamkang physics students not only learn fundamental principles in the classroom but also have opportunities to participate in world-class synchrotron radiation research projects and collaborate with leading international scholars in exploring AI-powered energy technologies — enabling them to fully realize the potential of AI in scientific innovation.


nature
A multimodal robotic platform for multi-element electrocatalyst discovery
CREST (AI System) ✦ Light Source (Physics)
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