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Innovation Pathway

G20 Summit Advances

Equitable Global Governance

By Staff Reporters

The 20th G20 Leaders' Summit in Johannesburg, South Africa, on November 22-23, constituted a landmark event in the history of the group, being the first time a G20 summit was hosted on the African continent.

While the African Union is a member, South Africa is the only African nation within the G20.

Over more than two decades of its evolution, the G20 has become a pivotal platform for global economic governance. Today, its members account for approximately 85 percent of global GDP and represent two-thirds of the world's population, making it one of the most critical platforms for global economic governance. There are strong international expectations that the G20 will take the lead in championing multilateralism, reforming and improving global governance, and promoting shared development.

This year, the Leaders' Declaration at the summit underscored the need for multilateral cooperation to tackle global challenges, and called for enhanced support for developing countries to advance inclusive growth and sustainable development.

The declaration comes at a time when the world is facing mounting geopolitical tensions, resurgent unilateralism and protectionism, weak global growth, and widening development gaps. The current global governance system is increasingly exposed as outdated and unbalanced, which has caused a deepening deficit.

A report released just before the summit starkly illustrated these disparities, revealing shocking North-South inequalities in wealth distribution, trade access, resource allocation, and education. This is a sobering reminder that lasting global prosperity and stability cannot be built on a foundation where the rich grow richer and the poor poorer.

It is precisely this context that gave the two-day summit, themed "Solidarity, Equality and Sustainability," exceptional significance. Global South countries issued broad appeals for renewed commitment to multilateralism, bridging the North-South development divide, and forging deeper cooperation.

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New Graphic

China's 5G applications
integrated into **86**
out of 97 major categories
of the national economy

As of November 2025



Application cases
in total

more than
138,000



5G+ industrial
Internet projects

more than
20,000

Source: Ministry of Industry and Information Technology
Designed by Science and Technology Daily

WECHAT ACCOUNT



E-PAPER



① China launches the Shenzhou-22 spaceship from the Jiuquan Satellite Launch Center in northwest China, on November 25, 2025.
② A Long March-2F Y22 rocket carrying the Shenzhou-22 spaceship blasts off from the Jiuquan Satellite Launch Center, on November 25, 2025. (PHOTO: XINHUA)

STI Frontier

Oysters Shield Marine Engineering Projects

By Staff Reporters

Marine engineering projects like cross-sea bridges and port dock banks, crucial for exploring and utilizing the sea, face a daily challenge: erosion by sea water.

Traditional anti-erosion paint has a strong odor and could pose a threat to the ecosystem. A research team from the College of Aerospace and Civil Engineering, Harbin Engineering University (HEU), figured out a unique solution: Let oysters do the trick.

Oysters stand out

According to Lv Jianfu, HEU professor and the team lead, marine sessile organisms can be used to prevent erosion, meeting not only the requirements of engineering construction, but also restoring the ecosystem.

The first step in adopting this method was to pick the right species. Lv and his team cooperated with other research

institutions, including the Institute of Oceanology, Chinese Academy of Sciences, to conduct field research and sea tests. Many sessile organisms were compared and screened, and oysters stood out.

Oyster reefs, formed by clusters of oysters growing in a fixed position, are known as "ecosystem engineers." They possess multiple ecological uses such as improving the water quality, enhancing biodiversity, and protecting coastlines.

Lv's team reconstructed the design logic of marine infrastructure by deeply integrating cement-based materials and marine organisms, pioneering the world's first integrated technology for high-durability marine concrete engineering and ecological restoration based on oysters.

This technology creates a biological armor for marine engineering projects, which is highly anti-corrosive, low cost and self-restorative.

By activating the natural power of marine sessile organisms like oysters, the

life of engineering projects such as piers and cross-bridges can be extended to more than 50 years.

Attracting and settling oysters

Research shows that the biological armor would leverage its protective capabilities fully only when marine sessile organisms cover more than 95 percent of the surface of the concrete works. Therefore, how to attract oyster clusters to voluntarily come to the targeted area and build a defense system became another key issue.

Lv's team designed a full-chain solution, which included artificial induction, material design and function integration, greatly enhancing the safety and durability of the concrete works.

Considering the sophisticated marine environment, Lv's team conducted tests at different marine engineer works, including cross-sea bridges and port wharfs in the Yellow Sea, the East China Sea and the South China Sea. See page 4

Innovation Drives Smart Maritime Progress

Edited by WANG Xiaoxia

Building China into a strong maritime nation is a high priority in its 14th Five-Year Plan (2021-2025). This is evidenced by a series of advancements over the past five years, with the support and guidance of sci-tech innovation in marine economic development, marine technological innovation and marine ecological protection.

Marine economy

The new generation 100,000-tonne smart aquaculture vessel can load 200,000 juvenile fish into the breeding hold in just 10 minutes, while the annual gas production of Deep Sea No.1 gas

field is expected to exceed 4.5 billion cubic meters. These are just some examples of the wealth of opportunity that lies beneath the ocean, driving the momentum of China's marine economy.

In the first quarter of 2025, the output of aquatic products across the country increased by 4.5 percent year-on-year.

In 2024, China's marine GDP exceeded 10 trillion RMB. The amount of new orders received, delivered orders and orders on hand for marine engineering equipment increased by 143 percent, 10.5 percent and 20 percent respectively year-on-year. This ensured China's international market share in marine economy remained the world's leader for sev-

en consecutive years.

Meanwhile, the research and development of marine drugs is advancing, such as the anti-tumor polysaccharide drug BG136 and the new anti-hepatitis B virus drug LY102.

Technological innovation has also become the core driving force for the development of the marine economy. Even traditional industries like aquaculture are increasingly adopting advanced technologies, said Professor Luan Weixin from Dalian Maritime University.

Major projects

Over the past five years, sci-tech innovation has played a key role, with several key milestones. See page 3

International Cooperation

Roundtable Calls for Int'l Cooperation in Space Science

By LU Zijian

"International cooperation has been very important, and will become more and more important in the future," Jean-Jacques Dordain, former director general of the European Space Agency (ESA), told *Science and Technology Daily* in an interview at the Roundtable for International Cooperation in Space Science in Beijing on November 21.

Organized by the Chinese Society of Space Research, the roundtable called for further global collaboration within the space science community to maximize scientific output and contribute to the advancement of knowledge.

Dordain regards the exploration of the universe and the solar system as an objective aimed at understanding the Earth and ensuring that humanity's future on the planet is as long as possible.

"It's a common objective for all humans and this is the reason we all have to contribute to that common objective," he said. "And this is the reason why international cooperation is so important."

However, global collaboration in space science is not an easy job. "You have to make sure that you understand your partner and trust your partner," Dordain said.

Alvaro Giménez, senior science advisor of the Spanish Space Agency, shared similar views. He mentioned three key elements for international cooperation, namely mutual benefits, commitment reliability, and mutual respect.

"All partners have to gain benefit from the cooperation... people have to respect the contribution of each partner," he said.

China has been cooperating with many countries and regions in space science.

Dordain said China has done a lot in international cooperation and gave the example of the Beijing-headquartered Asia-Pacific Space Cooperation Organization (APSCO), via which China offers other countries access to space data.

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WEEKLY REVIEW

China's 1st Emergency Launch in Manned Space Program Made

China launched the Shenzhou-22 spaceship to provide a return vessel for the three Shenzhou-21 astronauts in orbit on November 25. This momentous occasion marked the accomplishment of the first emergency launch mission in the country's manned space program.

Non-invasive Insulin Delivery Through Skin Achieved

A research team led by scholars from Zhejiang University has achieved the world's first non-invasive delivery of insulin through skin, securing a blood sugar-lowering effect comparable to regular insulin injections. The approach was recently published in *Nature*.

All-optical Modulation with Single Photons Using Electron Avalanche Developed

A Purdue University research team has developed a "photonic transistor" that precisely controls light at the single-photon level, a breakthrough published in *Nature Nanotechnology*. This device can operate at single-photon intensities, a long-standing challenge in photonics, and could enable the development of photonic chips and quantum computing by offering much higher speeds and lower power requirements than traditional methods.

New Method to Treat Orthotopic & Metastatic Pancreatic Cancer

A research team from the University of California, Los Angeles, developed allogeneic IL-15-enhanced, mesothelin-specific CAR-engineered invariant natural killer T (Allo15MCAR-NKT) cells through gene engineering. This new method is a promising next-generation immunotherapeutic approach for pancreatic cancers, with the potential to overcome critical challenges especially in the context of metastatic disease.

Industrial Parks to Get Digital Lift

Policy Express

Edited by SUN Jin

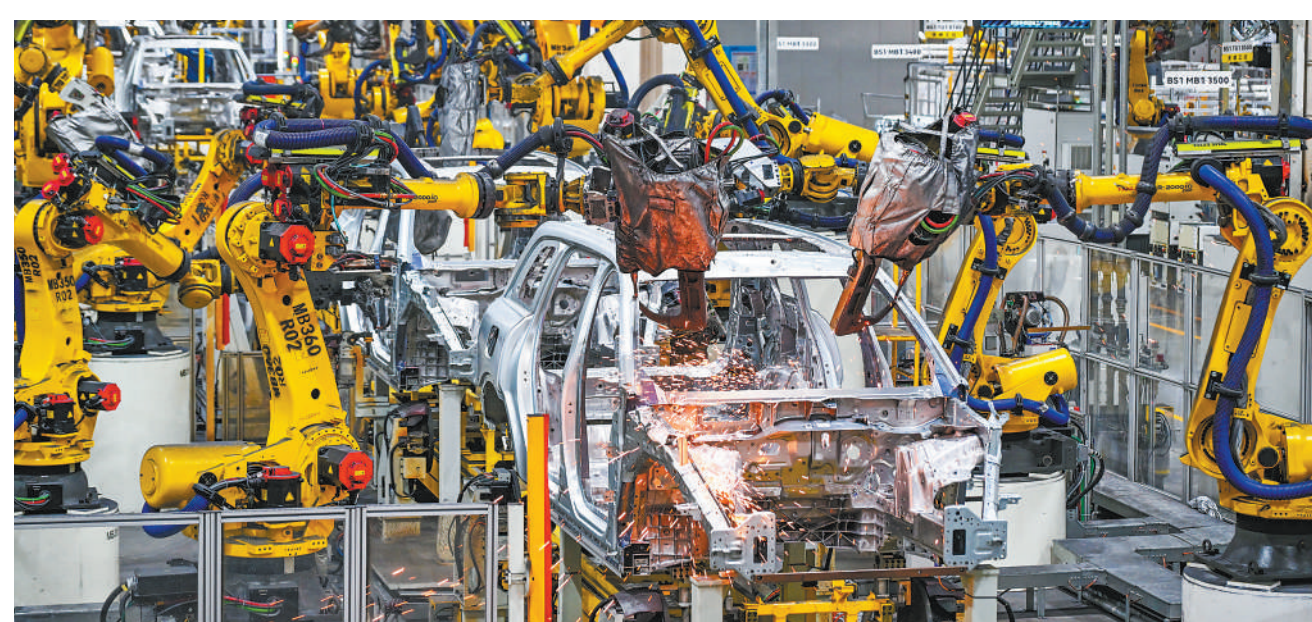
Targeting the construction of 200 high-standard digital parks nationwide by 2027, China's Ministry of Industry and Information Technology (MIIT) has released new guidelines to accelerate the process of this vision.

According to the guidelines, digital transformation of industrial enterprises and the high-quality development of industrial parks are required to meet specific criteria, including a high level of industrial digitization, high-quality professional services, and high operational management efficiency.

The guidelines specify that industrial Internet applications should cover all sectors within the parks. They also call for significantly strengthening digital infrastructure, with full coverage of dual-gigabit networks, effectively deploying and well-utilizing computing power facilities, and notable improvements in data openness, sharing and security protection.

Four principal tasks are outlined, including advancing industrial digital transformation, enhancing digital services, improving digital management systems, and strengthening foundational digital support capabilities.

Among the key tasks, there is a call to cultivate model enterprises in digital



The automated production at the Seres Super Factory in Liangjiang New Area, southwest China's Chongqing. (PHOTO: XINHUA)

transformation and accelerate the adoption of AI + manufacturing.

Companies are also encouraged to build smart factories in stages and expand the large-scale deployment of industrial robots and other intelligent equipment to drive productivity gains.

The guidelines promote chain-wide digital upgrades by supporting leading enterprises in digitizing supply-chain collaboration and opening application scenarios and technological capabilities to upstream and downstream partners.

In addition, there are plans to develop new data-driven services by creating platforms for data utilization and exploring the establishment of trusted data spaces to remove barriers to data sharing among multiple stakeholders, strengthen applications of AI + trusted data space, and spur data-service innovation across the parks.

To support this transformation within the parks, MIIT will leverage policy tools such as large-scale industrial equipment upgrade programs and pilot projects focused on digitization. These initiatives aim to accelerate the digital

transformation and the matching of supply and demand.

Local governments, industry regulators, and park management bodies are urged to fully leverage their resources to provide policy support and secure key factors, including strategic resources such as industry data for development, while actively guiding private capital to participate in the construction of high-standard digital industrial parks.



Low-carbon Practices Drive Green BRI

By MA Aiping & ZHONG Jianli

A clarion call for global collaboration to accelerate emission reductions and enhance climate resilience took center stage at the 30th Conference of the Parties to the United Nations Framework Convention on Climate Change (COP30), held in Belem, Brazil from November 10 to 21.

Focusing on the Belt and Road Initiative (BRI)'s green development, and promoting global ecological cooperation, the "Belt and Road" Eco-industry Cooperation Working Committee of the All-China Environment Federation (ACEF) hosted a side event at COP30 in the UN Press Room to share low-carbon practices and Chinese successful cases in this vital area of lowering emissions.

Representatives from five leading companies spanning new materials, automotive manufacturing, energy and digital

infrastructure presented their low-carbon transition roadmaps and results to provide innovative, replicable practice schemes for the BRI partner countries.

A highlight of the ACEF session was the presentation by Changzhou Power Supply Company of the State Grid Jiangsu Electric Power Co., Ltd., which unveiled its "Electric-Steam Cube" solution. Designed to address the industrial dilemma of securing steam power that is sufficient, low-cost and low-carbon, the technology offers a powerful engine for industrial green transformation.

The "Electric-Steam Cube" innovatively integrates three energy sources: photovoltaics (PV), off-peak electricity and industrial waste heat. Utilizing electrode boilers and high-temperature heat pumps, the system produces steam at temperatures between 120 and 160 degrees Celsius.

To overcome the challenge of energy intermittency, the company developed large-scale thermal storage tanks. These tanks use high pressure to condense steam into water for storage; when needed, the pressure is released to revert the water to steam. The system achieves an energy conversion efficiency of over 95 percent, ensuring a continuous, stable and flexible supply of clean steam.

Beyond the technology, the company introduced a collaborative business model combining "technology licensing and construction investment." By uniting energy service companies, equipment manufacturers, and energy consumers, the model has accelerated the large-scale adoption of clean energy technology.

To date, 118 of these models have been deployed across eight provinces in China, generating direct economic

benefits of 830 million RMB. Environmental metrics are equally impressive: the system reduces carbon dioxide emissions in the steam production process by over two-thirds and completely eliminates sulfur dioxide and nitrogen oxide emissions.

Furthermore, the cost of the system is only one-sixth that of electrochemical energy storage. It functions as a flexible composite resource capable of responding within 30 seconds to absorb fluctuating PV power, thereby enhancing the stability of new power systems.

Observers said with wider promotion of the proven successful cases, the BRI green cooperation is entering a new phase. The initiative is solidifying its role as a "bond" in global climate governance, contributing Chinese wisdom and solutions to the building of a clean and beautiful world, in line with COP's vision.

G20 Summit Advances Equitable Global Governance

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They called for a more equitable, inclusive and sustainable global development framework capable of bringing greater stability to an uncertain world.

China, a prominent G20 member and the world's largest developing country, proposed the Global Governance Initiative in September, centered on five core principles: upholding sovereign equality, adhering to the international rule of law, practicing

multilateralism, advocating a people-centered approach, and prioritizing concrete actions.

This initiative has garnered widespread recognition, highlighting China's constructive role in providing global public goods and advancing fairer global governance.

China-Africa cooperation illustrates how Global South partnerships can translate shared priorities into tangible development gains. Grounded in the development realities of African countries,

this cooperation has strengthened their capacity and drawn greater attention to Africa's long-neglected development agenda.

It has also helped amplify the collective influence of the Global South in global governance reform.

China and Africa have amplified the voice of the Global South, enhancing its collective influence in international affairs and jointly steering the global order toward greater fairness and reasonableness.

Global governance is at a new historic turning point, and the need for multilateral cooperation and shared development has never been greater. As major forces of the Global South, China, Africa, and other developing countries should continue working together, uphold fairness and justice, and advance practical cooperation to help steer global governance toward a more just and equitable system.

Source: XINHUA

Roundtable Calls for Int'l Cooperation in Space Science

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APSCO Secretary-General Jiang Hui elaborated on this, saying the organization emphasizes resource sharing among member states to advance fundamental scientific knowledge while delivering tangible social economic benefits, particularly for developing countries in the Asia-Pacific region.

The cooperation between China and Europe has been consistent. "Twenty years ago, I was here in Beijing to sign a cooperation agreement between ESA and China National Space Administration, so I am a strong believer in the cooperation with China," Dordain said.

In 2015, SMILE, the Solar Wind Magnetosphere Ionosphere Link Explor-

er mission, was selected from a pool of 13 potential missions proposed to the Chinese Academy of Sciences and ESA. The mission aims to build a more complete understanding of the Sun-Earth connection by measuring solar wind and its dynamic interaction with the magnetosphere.

According to ESA, SMILE is due to

launch on a European Vega-C rocket in spring 2026.

For further cooperation, Dordain said China and Europe can combine their best assets. China has a relatively large volume of activities and space technologies, and Europe has, what he called "the best understanding of what means cooperation."

Global Journal Observatory

CPL: Rapid Publication of Leading Scientific Achievements

By XIANG Tao

Chinese Physics Letters (CPL), launched in 1984, is the flagship journal of the Chinese Physical Society and the Institute of Physics, Chinese Academy of Sciences. Over the past four decades, it has evolved into a vital platform for Chinese physicists to engage with the global research community, while also chronicling the remarkable development of physics in China.

Rooted in China, influencing the world

CPL embodies the aspirations of Chinese physicists for the advancement of physics in the country, serving as a bridge for academic exchange between the Chinese and international physics communities.

The advisory editorial board consists of eminent physicists such as Chen-Ning Yang and Tsung-Dao Lee, who with their academic insight and global perspective guide the journal's positioning and development direction. This top-level design has laid a solid foundation for CPL's high-quality development.

During his distinguished academic career, Professor Yang published seven papers of significant academic value in CPL. His contributions not only reflect how senior scientists have helped elevate the standing of Chinese physics on the global stage, but also inspire generations of young scholars to pursue academic excellence in service of the nation.

Over the years, CPL has published a series of influential achievements that represent China's highest level of scientific research, earning Chinese physicists international recognition. A landmark example is a breakthrough by a team led by academician Zhao Zhongxian.

In 2008, they raised the critical temperature of iron-based superconductors to 55 K, a record that remains unbroken. Following rapid publication of the feat in CPL, the work was selected by *Science* magazine as one of the "Top 10 Scientific Breakthroughs of the Year."

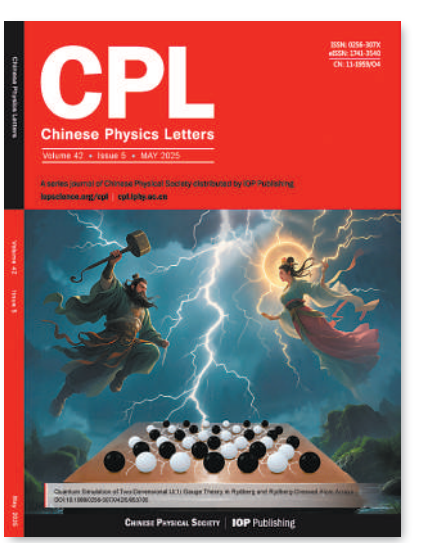
Another notable contribution came from academician Xue Qikun's team in 2012, reporting a breakthrough in interfacial high-temperature superconductivity, opening up new research directions in the field.

Strengthening academic quality and service capabilities

Since 2019, CPL has entered a phase of rapid development. Both its academic standards and service capabilities have been significantly enhanced.

The editorial board conducts rigorous pre-screening of all submissions and ensures precise matching of reviewers, making the peer-review process both efficient and fair. The quality of published articles has improved and the journal's impact factor quadrupled over the past six years. In 2024, CPL entered the JCR Q1 category.

In recent years, CPL, together with three other leading physics journals in China — *Physics*, *Acta Physica Sinica* and



Front cover of Chinese Physics Letters, Volume 42, Issue 5. (COURTESY PHOTO)

Chinese Physics B — has been organizing a "Special Symposium on Chinese Physics Journals" at the annual Chinese Physical Society Autumn Conference. This academic event has expanded to include more than 20 domestic journals, becoming an important platform for exchange within the Chinese physics community.

Rapid publication of science achievements

In 2012, under the leadership of then editor-in-chief Zhu Bangfen and the associate editors, CPL started a special section titled "Express Letters," dedicated to the rapid publication of significant original research. This section has earned strong recognition within the Chinese physics community and plays an active role in enhancing the international visibility of China's major scientific achievements.

A notable example took place in 2019. The team of He Ke, Xue Qikun and Xu Yong from Tsinghua University experimentally discovered an intrinsic magnetic topological insulator, Mn-Bi₂Te₃, which can serve as a platform for studying and regulating various topological states and effects.

They submitted their manuscript to CPL, which quickly published it in "Express Letters" and it subsequently featured in a research highlight by *Physics World*. The rapid publication of this achievement demonstrated CPL's role as a core journal for Chinese physics, timely disseminating cutting-edge academic achievements and fostering international academic exchange.

As the editor-in-chief, I am proud of the journal's rapid growth, while also deeply aware of the heavy responsibilities that lie ahead. In the future, we will continue to uphold our strengths in rapidly publishing high-level achievements, and adhere to the principle of "relying on scientists and serving scientists."

We are committed to facilitating deeper and broader academic exchange between the Chinese and international physics communities.

The author is the editor-in-chief of Chinese Physics Letters.

Journal Review

Over the past 40 years, CPL has witnessed the remarkable development of Chinese physics from its rise to integration into the global scientific stage and participated in it.

Distinguished Chinese scientists such as Zhao Zhongxian and Xue Qikun have increasingly chosen to publish their landmark research findings in this journal, reflecting its growing academic appeal.

The unique value of CPL lies in its success in pursuing academic excellence and showcasing China to the

world. It has offered a rapid publication channel for a series of influential original achievements, such as iron-based high-temperature superconductivity and topological insulators, and enhanced their international visibility.

This highlights its irreplaceable role as a platform for academic exchange between the Chinese and international physics communities.

— Lin Haiqing, professor, School of Physics, Zhejiang University

U.S. Wields 'Security' to Justify Discriminatory Patent Rule



By LIANG Yilian & HU Dingkun

The United States Patent and Trade-mark Office (USPTO) has revised transparency rules related to patent invalidation petitions in the name of "national security," with a focus on applications submitted by foreign entities.

China's Ministry of Commerce said the revision constitutes a discriminatory restriction on the legitimate rights of Chinese companies.

On October 28, John A. Squires, the director of the U.S. Department of Commerce's Patent and Trademark Office, signed a memorandum making major changes to the rules governing inter partes review (IPR) petitions for patent invalidation. The new rules require petitioners to fully disclose all real parties in interest.

The IPR is a procedure within the USPTO for challenging issued patents. Typically, a company uses this procedure to submit technical evidence showing that another company's patent lacks "inventiveness" or "novelty," and petition the USPTO to invalidate that patent.

The memorandum defines the rule



The photo shows the headquarters of SMIC (North) in Beijing. (PHOTO: VCG)

change as a "national security measure," naming several Chinese companies on the U.S. Commerce Department's "entity list as having submitted large numbers of IPR petitions." They include YMTC, Huawei, DJI, and SMIC.

The memorandum says that such procedures should not be used by "foreign adversaries" to "harass" U.S. patent holders or otherwise give an advantage to those who "harbor malicious intent

toward the United States."

It is clear that China is the primary target of the rule change, and Chinese tech companies — or those with Chinese investment — will now face more stringent scrutiny when filing IPR petitions.

This heightened scrutiny is already becoming a reality.

On November 10, the USPTO issued a show cause order to YMTC, asking the company to explain within 14

days why it continues to pursue an IPR against U.S. firm Micron Technology despite being on the entity list and "reasonably believed to be engaged in or likely to engage in activities detrimental to U.S. national security or foreign policy interests."

Dennis Crouch, law professor at the University of Missouri, said the memorandum signals that the United States will adopt an anti-China strategy in its patent system, and the YMTC case suggests this strategy has already taken "its first step."

By overstretching the concept of "national security," the U.S. is erecting barriers to Chinese companies' petitions in a bid to tilt the playing field in patent disputes and increase the difficulties Chinese firms face operating overseas.

In recent years, as more Chinese products enter global markets, Chinese companies have frequently encountered patent disputes or even patent "trolling."

When Chinese firms believe that certain technologies should not qualify for patents but have been granted U.S. patents — leading to high royalty demands — petitioning to invalidate those patents is an important means of safeguarding their rights.

But now the discriminatory IPR rules will put Chinese companies at an inherent disadvantage in such disputes.

Voice of the World

Resilient Chinese Economy Brings Global Prosperity

By QI Liming

In the first three quarters of 2025, China's GDP grew by 5.2 percent year-on-year. The economy maintained a generally stable and improved development trend, injecting certainty and stability into the global economy. Looking ahead, China is well placed to lead global cooperation with a more open and inclusive attitude and create a future of shared prosperity.

Driving global economic growth

Achieving this growth is especially commendable amid current geopolitical tensions and global economic uncertainty, said Luis Fernandez, senior researcher at the World Economic Research Center of the University of Havana. He emphasized that China's steady economic growth plays a vital role in the global economy and will significantly benefit countries that cooperate with China.

Patricio Giusto, director of the Sino-Argentine Observatory, said in the first three quarters, the total industrial output value of enterprises above designated size across China increased by 6.2 percent year-on-year, while the growth rate of industrial production showed a steady and positive trend. The equipment manufacturing industry and high-tech manufacturing sector performed particularly well, he added, noting that development of AI has ushered in a historic opportunity. "This data have convinced people that China is fully capable of achieving the expected economic growth target for the entire year of 2025," Giusto said.

Janusz Piechociński, former deputy prime minister and economy minister of Poland, noted that China's stable economic performance is closely tied to its vast consumer market, comprehensive industrial supply chains, and the visionary and scientific approach of its macro-economic policies. He highlighted that China is home to the world's largest middle-income population, whose strong domestic demand provides a powerful engine for the country's internal economic cycle.

Mercedes Pita, the director of communications for the World Sustainability Foundation, Ecuador, said the stable

operation of China's economy and its continuous expansion of opening up are of great significance to global economic growth.

Deepening reform and opening-up benefits the world

Bernard Dewit, president of the Belgian-Chinese Chamber of Commerce, believes that, "A country with a continuously growing economy and an increasingly open market plays a crucial role in maintaining global stability and promoting common prosperity." China is unwaveringly committed to comprehensively deepening reform and opening up, sending out positive signals such as confidence, cooperation and inclusiveness to the international community. In the current era where an increasing number of global challenges require countries to work together to address these, China is injecting strong impetus into building a more resilient and mutually beneficial world economy, said Dewit.

Leung Chee Wah, secretary-general of the Association of Belt and Road Malaysia, said China emphasizes the development of new quality productive forces, which will bring extensive cooperation opportunities to global partners including Malaysia, such as opportunities for technology implementation and market alignment, promoting the establishment of a more closely-knit and mutually beneficial cooperative framework.

Jürgen Klute, the co-founder of the Europe Silk Road Connect, said the uncertainty of the international environment has not weakened the resilience of China's economy. China has demonstrated a firm determination and policy stability in responding to external pressures and promoting high-quality development. The pace of China's opening-up and innovation will keep moving forward.

Luigi Gambardella, president of the Brussels-based international digital association ChinaEU, considered that China has become an indispensable engine driving global industrial transformation. China's experience in the digital economy, green development, poverty alleviation and other fields will provide references for countries seeking stable growth.

Drones Carry Low-Altitude Economy Success

Opinion

By LIANG Yilian & ZHANG Jiaxing

Imagine you're a thirsty tourist trekking up the steep stone steps of the remote Badaling section of the Great Wall, and you desperately need a cold drink to cool down. Now, it is as easy as placing an order on your phone and waiting for a drone to bring it to you.

Examples of such services also extend to drones carrying emergency plasma weaving across the Wuhan city skyline.

These operations all form part of low-altitude logistics — or drone-based transport operating below traditional aviation heights — which has transformed the idea of "being out of reach" into

something reliably available at the touch of a phone screen.

When "low-altitude economy" appeared in China's 2024 Government Work Report for the first time, it signaled the rise of a new strategic industry. Yet among the many scenarios where low-altitude applications could develop, logistics has emerged as the first to go commercial. This is no coincidence, as it actually reflects the readiness of Chinese technology, and the strength of an institutional framework that encourages rapid change and deployment.

China's logistics system has long been both a marvel and a stress test. Daily parcel volumes soared from 100 million in 2019 to peaks of 729 million in 2023 and now push toward an almost unimaginable one billion parcels a day, according to Jin Bing, former official of the State Post Bureau of China. What

once was able to expand by hiring more couriers or buying more trucks has reached its limits. Put simply, human-based logistics cannot scale up at the speed the market demands.

This shift is already visible in Chinese cities, where drones are "halving delivery times," as *The Irish Times* recently observed, by flying packages to neighborhood drop-off stations for couriers to finish the final stretch. What began as experimentation has quickly accelerated into mass deployment. According to Jin, one major logistics company opened more than 500 drone routes in 2024 alone — more than twice its total from the previous decade. In Shenzhen, some sorting hubs see over a thousand drone takeoffs and landings each day, supporting a drone-express network that reliably fulfills 20,000 to 30,000 orders daily. China's B2C online retailer JD.com's drones, operating routinely in seven provinces, have cut delivery times in remote mountain regions from 72 hours to just three.

Beyond scale, integrated systems are redefining efficiency. SF Express, China's largest courier, and Shenzhen Metro have launched the country's first "rail-based logistics station," knitting together aerial drones, ground depots, underground unmanned vehicles, subway corridors, airport hubs, and large cargo aircraft. This model, already spreading across Zhejiang province and the Greater Bay Area, cuts delivery time by up to

80 percent and logistics costs by up to 50 percent, proving that low-altitude logistics is not an experiment — it is a viable business model.

Policy has been the quiet but decisive enabler of this momentum. Since early 2024, Chinese regulators have introduced a series of coordinated measures: support for unmanned delivery and low-altitude logistics, the promotion of integrated air-ground transport systems, and guidance for developing drone-based feeder routes and last-mile services. This consistency has created something rare in the global landscape: a regulatory ecosystem designed to build rules in parallel with rapid deployment. It is an advantage far more powerful than any single technical breakthrough.

China has approached the low-altitude economy as both a frontier for innovation and a form of public infrastructure. The result is an ecosystem in which manufacturers, operators, city planners, and regulators evolve together.

As *The Economist* noted in a recent analysis of the sector, Chinese companies can "develop products faster than their counterparts elsewhere." The deeper truth is that China's advantage is not only speed, but coherence. China is building a complete model — technological, operational, and regulatory — that other countries may eventually look to as a template rather than a curiosity.

ment of almost 1,780 kilometers of coastline and over 795,000 mu of coastal wetlands. In addition, 138,000 mu of mangroves have been planted.

Technology provides significant support to marine ecological protection. An independently developed environmental monitoring buoy has been in continuous operation for 20 months. The Shouwangzhe-1 tsunami warning surface buoy connects to the recording platform operating at a depth of 5,100 meters on the seabed, forming part of a national marine observation network.

According to the MNR, the country will continue enhancing innovation in marine science and technology, modernizing marine industries, and comprehensively promoting the construction of marine culture.

Innovation Drives Smart Maritime Progress

From page 1

This can be found in the development of polar icebreakers, scientific expedition vessels, deep-sea diving equipment as well as oil and gas platforms:

- In 2022, China developed the world's first amphibious unmanned aerial vehicle, Nezha, that flies, hovers and dives underwater.

- In 2023, the main line of the Shenzhen-Zhongshan Link, a mega cross-sea passage in the Guangdong-Hong Kong-Macao Greater Bay Area, was fully connected.

- In 2024, Qilinqing Station in Antarctica, China's fifth research station on the continent, began operation, while

the country's first domestically designed and built deep-sea drilling vessel, Dream, was commissioned.

- In 2025, the second phase of Deep Sea No.1 gas field became fully operational.

Looking ahead, it is necessary to continuously tackle core technologies, deploy major marine projects, and strengthen the construction of innovation platforms, and ultimately promoting innovation-driven development.

Green development

Coral reefs, known as "tropical rainforests on the seabed," are one of the most biodiverse marine ecosystems. In recent years, scientists from Guangxi

University have been protecting and restoring the coral reefs on Weizhou Island, in south China's Guangxi Zhuang autonomous region. They built a 2,000-square-meter demonstration area, successfully curbing the degradation of coral reefs. In just three years, the coverage rate of living coral in the area increased from about five percent to 20 percent.

From north to south, along China's long coastline, a series of practices are being established to protect the marine ecology. According to the Ministry of Natural Resources (MNR), China has to date supported nearly 200 major projects for marine ecological protection and restoration, driving the improve-



Meituan's drone logistics delivery business is booming in Shenzhen. (PHOTO: VCG)

AI-powered Meteorological Service System 'Fenghe'

Hi-Tech

By LI Linxu

The China Meteorological Administration (CMA) recently unveiled its AI meteorological service system, Fenghe (literally "Wind Harmony"), aiming to revolutionize meteorological service models and achieve intelligent transformation in weather forecasting and public services.

Currently, Fenghe comprises five core modules: a meteorological knowledge center, a model square, a meteorological AI toolbox, an agent factory and an evaluation lab.

Its key capabilities include understanding meteorological service demands, generating tailored content, performing weather-related reasoning and decision-making, and calling specialized meteorological tools.

By accessing Fenghe via a mini-program or web platform, users can input weather-related queries and receive automated responses. Covering scenarios from science popularization Q&A and weather inquiries to disaster warnings and industry-specific advice, Fenghe provides personalized recommendations

based on intelligent analysis.

For instance, for a family driving from Shanghai to Baiyangdian Lake during a thunderstorm, it can suggest alternative indoor attractions while avoiding waterlogged highway sections during peak storm hours.

Fenghe will undergo regular evaluations by an expert team to ensure its competitiveness as a vertical domain model.

Behind Fenghe's launch are breakthroughs in core technologies, such as a trillion-scale meteorological corpus for training, LoRA-based fine-tuning to enhance domain-specific knowledge, reinforcement learning from human feedback for advanced reasoning, and multi-agent collaboration tailored for meteorological service scenarios, ensuring stable performance and user experience.



The China Meteorological Administration's AI meteorological service system "Fenghe." (COURTESY PHOTO)

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 print-heads, 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.

The implications stretch across



Dr. Adam Rushworth. (COURTESY PHOTO)

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.

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 mod-

els 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.

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

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,



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

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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