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China, Turkmenistan Deepen Energy Ties

By Staff Reporters

Chinese President Xi Jinping's Special Representative and Vice Premier of the State Council of China Ding Xuexiang recently traveled to Turkmenistan to attend the ground-breaking of the fourth phase of the Galkynysh gas field.

During the visit, Ding Xuexiang met separately with National Leader of the Turkmen People and Chairman of the Halk Maslahaty of Turkmenistan Gurbanguly Berdimuhamedov, and Turkmen President Serdar Berdimuhamedov.

He also co-chaired the seventh meeting of the China-Turkmenistan Cooperation Committee with Turkmenistan's Deputy Prime Minister and Foreign Minister Rashid Meredov.

Ding and Gurbanguly Berdimuhamedov jointly attended the ground-breaking of the fourth phase of the Galkynysh gas field.

Ding said the phase embodies the ardent expectations of the leaders of both countries and the shared aspirations of the two peoples. The project will further elevate energy cooperation between China and Turkmenistan to a new level.

He proposed prioritizing quality and building a premium, high-standard project. He also noted that both sides should pursue innovation-driven development and make the project a benchmark, setting an example for major natural gas projects. He said China and Turkmenistan should adhere to win-win cooperation and make the project a symbol of friendship.

Natural gas cooperation is a cornerstone of China-Turkmenistan relations and has delivered tangible benefits to both peoples.

Ding also said the two countries should enhance cooperation in non-resource areas such as connectivity, economy and trade, investment, agriculture, as well as digital economy, and cultivate new growth drivers. They should jointly promote China-Central Asia cooperation and work together with regional countries for development and prosperity.

Serdar Berdimuhamedov said his country highly values its comprehensive strategic partnership with China, and is ready to deepen traditional friendship with the Chinese side, take natural gas development as the priority direction, and strengthen practical cooperation in various fields.

Turkmenistan highly appreciates the four global initiatives proposed by President Xi — the Global Development Initiative, the Global Security Initiative, the Global Civilization Initiative and the Global Governance Initiative. Serdar Berdimuhamedov said Turkmenistan will support China in hosting the third China-Central Asia Summit.

Ding witnessed the signing of cooperative documents for establishing cultural centers, transport and logistics, AI, science and technology, and traditional medicine.

He also attended the opening ceremony of a symposium marking the 20th anniversary of strategic cooperation between China and Turkmenistan in the natural gas sector and the launch of the Luban Workshop in Turkmenistan.



The first Hualong One nuclear power unit in the Guangdong-Hong Kong-Macao Greater Bay Area — Unit 1 of China General Nuclear Power Group Taipingling nuclear power project, commenced power generation on April 20 in Huizhou, south China's Guangdong province, officially entering commercial operation. (PHOTO: XINHUA)

Advancing Cooperation Under GDI

By LU Zijian, TANG Zhexiao & FU Lili

Hosted by the China International Development Cooperation Agency (CICA), the Third High-level Conference of the Forum on Global Action for Shared Development was held in Beijing on April 22.

This year marks the fifth anniversary of the Global Development Initiative (GDI) proposed by Chinese President Xi Jinping to boost global efforts to achieve the UN sustainable development goals. The attendees shared their thoughts on climate change and green development, and digital economy, which are among the eight prioritized cooperation areas of the GDI.

As global climate change intensifies, extreme weather events are having a significant impact on people's lives

and economic activities.

Zhang Xingying, director-general of the Department of International Cooperation of China Meteorological Administration (CMA), noted that the "MAZU" early warning system — a Chinese cloud-based meteorological system designed to help countries better broadcast extreme weather — has been deployed in seven countries since its launch in July 2025, including Pakistan and Djibouti. More than 40 other countries are using its cloud-based service.

During the meteorology sub-forum, the CMA launched the new-generation public cloud version of the MAZU system, and officially handed over customized MAZU systems to Sri Lanka and Jordan on site.

Ra'ed Ahmad Subhi Rafid, director of Jordan Meteorological Department,

pointed out that extreme weather events such as sandstorms, dusty storms and heat waves are increasingly affecting Jordan. The customized MAZU system integrates AI and satellite data models, supporting forecasters and decision makers in their work.

Athula Kumara Karunanayake, director general of the Department of Meteorology of Sri Lanka, said the customized MAZU system enables forecasts of varying lead times — from one day to three months — tailored to different sectors. With precise forecasts, relevant agencies such as the water authorities can take timely and necessary actions.

"This will bring more benefit. We can minimize our people's death and economic damage, and that is good for our nation," Karunanayake said.

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STI Frontier

Powerful TBM: Digging Deep into the Earth

By LU Zijian & SUN Yu

Named Gangtie Jiliang, or Steel Backbone, it is the world's first kilometer-scale, vertical shaft, hard-rock, full-face tunnel boring machine (TBM). The revolutionary borer recently wormed its way deep into the ground at an iron ore project site of Ansteel Group Corporation Limited in Anshan, northeast China's Liaoning province.

Since 2021, China Railway Construction Heavy Industry Corporation Limited (CRCHI) has assembled a dedicated R&D team to tackle key earth boring challenges, successively overcoming three core technologies — excavation, muck removal, and support. The end result was the development of Gangtie Jiliang.

'Pencil sharpener' breakthrough

The geological conditions get more complex as the TBM goes deeper, and

excavating hard rock becomes a key challenge.

The research team first upgraded the cutterhead for Gangtie Jiliang. To comply with the characteristics of vertical shaft excavation, the researchers designed a conical cutterhead with automatic alignment correction based on the cutterhead used by conventional shield TBMs, along with selected cutters that are highly effective in breaking rock.

However, the new cutterhead took a major battering when the test TBM dug to around 160 meters of a highway project vertical shaft in Panzhihua, Sichuan province.

Due to the sudden increase of rock hardness to 140 MPa, the excavation efficiency of the test TBM dropped from 10 mm per minute to five mm per minute. The team inspected the cutterhead and found uneven wear on the cutter rings

and damaged bearings. Measures were needed to reduce the lateral forces acting on the cutterhead during excavation.

Pencil sharpening inspired the research team. "Previously, we assumed that equipment in a vertical shaft achieves maximum rock-breaking force when excavating horizontally, which is why the standard cutting tools on the cutterhead were always oriented perpendicular to the face," said Ke Wei, a designer of the excavation system of Gangtie Jiliang.

"But the experience of sharpening a pencil reminds us that when the blade is held against the pencil, a smaller cutting angle actually makes sharpening easier. This suggests that angling the cutting tools when drilling rock might actually result in greater rock-breaking force," said Ke.

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International Cooperation

AI Weather Alert System for BRI Countries

Edited by WANG Xiaoxia

An intelligent AI driven weather forecasting system for Belt and Road Initiative (BRI) partner countries, was recently launched in China.

Initiated by the Ministry of Science and Technology and led by the Earth system numerical prediction center at the China Meteorological Administration (CMA), the forecasting system demonstration project focused on the urgent needs of BRI partner countries.

Relying on China's technological accumulation in AI, meteorological satellites, and numerical forecasting, it will build an all-day intelligent meteorological forecasting system, and upgrade the cooperation mechanism from single-way technology transfer to joint R&D and capacity building.

Han Wei, project leader and deputy chief engineer of the Earth system numerical prediction center at the CMA, said the project promotes the localization and application of AI technology in the BRI partner countries, through various means such as joint research and development, data sharing, and application demonstrations.

The project plans to develop five core AI models, covering key areas such as intelligent fusion of multi-sphere observations, intelligent short-term and near-term forecasting, and regional downscaling. At the same time, it will develop an intelligent weather forecast all-in-one machine that can flexibly adapt to the infrastructure of different countries.

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WEEKLY REVIEW

Pakistani Astronauts Selected for China's Space Mission Training

Two Pakistani candidates Muhammad Zeeshan Ali and Khurram Daud have been selected as the first foreign astronauts for China's space mission training, the China Manned Space Agency announced on Wednesday. The agency said they will come to China soon as reserve astronauts for training. After completing all training and evaluations, one of them will participate in a space mission as a payload specialist, becoming the first foreign astronaut onboard the Tiangong space station.

Math Wiz Chinese Women Win Breakthrough Prize

Three Chinese women mathematicians — Wang Hong, Tang Yunqing, and Zhang Mingjia — have been recognized in the 2026 Breakthrough Prize awards for their exceptional contributions to mathematics. Often dubbed the "Oscars of Science," the Breakthrough Prize honors groundbreaking achievements in life sciences, fundamental physics and mathematics.

Black Hole Jets Measured for First Time

Scientists have measured black hole jets by using a planet-sized network of radio telescopes. Focusing on Cygnus X-1, one of the first known black holes, they measured jets blasting out with the energy of 10,000 Suns and moving at half the speed of light. The study was published in *Nature Astronomy*.

Missing Vitamin B7 Could Stop Cancer Cell Growth

In a study published in *Molecular Cell*, researchers at the University of Lausanne have uncovered a new biological mechanism that exposes a critical vulnerability in tumor cells when they are deprived of vitamin B7. Mutations in a cancer-linked gene can make this vulnerability even stronger, offering a promising new target for therapy.

New Graphic



China Launches Action Plan for AI+Education

Policy Express

By LI Linxu

In its latest efforts to become an education powerhouse, China has launched an AI+education action plan.

The plan was jointly released by five government bodies, including the Ministry of Education, the National Development and Reform Commission, and the Ministry of Science and Technology.

By 2030, a framework for the deep integration of AI and education will be basically established. A comprehensive AI education system covering all stages of education and a general education system for the entire society — characterized by vertical continuity and horizontal connectivity — will be built.

The scale and quality of AI talent cultivation will be significantly improved, and a long-term mechanism for nurturing AI literacy will be formed.

Systemic transformation will be achieved in educational and teaching models, scientific research paradigms, and governance modes.

The capacity for education service



A teacher shows cartoon images of students generated by AI technology. (PHOTO: XINHUA)

supply and the level of modernization will be substantially elevated.

The foundational support environment will become more intensive and efficient, while the innovation ecosystem will grow more open and collaborative.

The application of intelligent tech-

nologies will become more inclusive, secure, and efficient, cultivating a batch of high-value, scalable, and replicable application scenarios.

A new form of smart education will take shape, with its global influence reaching the forefront.

To achieve such goals, efforts will be made to speed up the rollout of AI education in primary and secondary schools, citing measures such as integrating AI education into local curriculum systems, encouraging cross-disciplinary AI teaching, and building AI education bases.

Efforts will also be made to cultivate high-level talent tailored for the intelligent era, pushing for establishing AI as a basic public course in universities and developing specialized textbooks categorized by academic disciplines.

It urges efforts to accelerate the upgrading and transformation of traditional disciplines in vocational education, advance public AI awareness and literacy initiatives, and improve the AI competencies and pedagogical skills of educators across all levels.

The plan calls for leveraging AI to empower learning, teaching, educational governance, and scientific research.

It also highlights advancing research and innovation in AI+education, strengthening the enabling conditions and support systems for AI+education, and promoting international cooperation in AI+education.



IJM: Putting Asian Math Research on Global Stage

By Yasuyuki Kawahigashi

In the late 1980s, the global mathematical community was undergoing a significant transformation. The field was moving away from a purely Western-centric focus toward a more inclusive, pluralistic era where groundbreaking research was increasingly emerging from Asia. However, a dedicated platform was missing to bridge these regional developments with the wider international audience.

It was in this environment that the *International Journal of Mathematics (IJM)* was conceived. Dr. K. K. Phua, chairman of World Scientific Publishing Company in Singapore, approached the legendary Professor Shiing-Shen Chern, a pioneer of modern differential geometry known as a "global citizen of science," with a proposal to establish World Scientific's first dedicated mathematics journal.

Professor Chern immediately recognized the potential to elevate Asian scholarship. Alongside esteemed German mathematician Friedrich Hirzebruch, who joined as an honorary editor, they lent their immense intellectual authority to ensure *IJM* would be a forum of the highest caliber. Their mission was clear: Scientific excellence knows no borders, and *IJM* would be the vehicle to prove it.

A tradition of editorial excellence

Since its inaugural issue in March 1990, *IJM* has been guided by the distinguished minds in the field. Our "rigorous standards" are not merely a phrase; they represent a tradition of excellence where every submission undergoes stringent peer review by world-leading specialists.

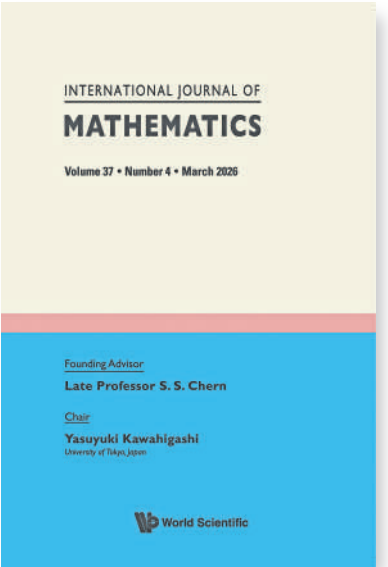
This standard was established from day one by a founding editorial board that featured giants such as Kung-Ching Chang of Peking University and Shigefumi Mori of Nagoya University — a Fields medalist whose participation ensured the journal's prestige from its inception.

The strength of our current board is further evidenced by the inclusion of 12 invited speakers of the International Congress of Mathematicians. These invitations are among the highest honors in mathematics, and having such representation from China, Japan, South Korea and India ensures that *IJM* maintains a deep connection with the Asian community while preserving a truly international outlook.

A catalyst for Asian mathematical science

IJM has been a powerful springboard for Asian mathematicians, providing a platform where work is judged solely on its scientific merit. The publication records tell the story of a thriving regional community that has gained global visibility through our pages.

Leading our list of prolific contributors is Indranil Biswas from the prestigious Tata Institute of Fundamental Research in Mumbai, India. With



Front cover of International Journal of Mathematics, Volume 37, Issue 4. (COURTESY PHOTO)

an extraordinary 45 papers published in *IJM*, his work has significantly influenced the global research landscape in algebraic geometry and related fields.

The journal has been a vital venue for Chinese scholars such as Lin Huaxin, winner of the Frontiers of Science Award at the 1st International Congress of Basic Science. His work in operator algebras, along with contributions from Shen Zhongmin (13 papers) and Daniel Zhuang-Dan Guan (10 papers), Wang Youde (nine papers) has helped solidify China's reputation as a mathematical powerhouse.

IJM continues to attract the world's most recognized leaders, such as Fields medalist Ngo Bao Chau from the University of Chicago. His 2024 publication, "The companion section for classical groups," reinforces *IJM*'s role as a bridge linking the most established world leaders with emerging Asian scholars.

Our future: Linking generations and continents

Looking to the future, *IJM* remains committed to nurturing the next generation of talent. We are expanding our regional editorial networks and encouraging submissions from the rapidly growing number of young research groups across Asia.

We believe that mathematics is a universal language shared across cultures, regions and generations. Unlike other disciplines, mathematical truths are absolute and unchanging, providing a unique common ground for dialogue between nations.

By upholding the rigorous scholarly standards, we aim to remain the key bridge linking Asian research with the global stage. In doing so, we ensure that this universal language continues to flourish, connecting the brilliance of the past with the innovations of the future.

The author is the editor-in-chief of *International Journal of Mathematics*, and a professor at The University of Tokyo.

Journal Review

IJM, the flagship mathematics journal of World Scientific, has long been committed to academic excellence and global vision. With rigorous peer-review standards ensuring its high quality, the journal has been advancing academic exchange and frontier exploration in mathematics worldwide.

IJM boasts an international and high-level editorial board, upholding the philosophy of originality first and depth priority. It is dedicated to publishing high-quality work with independent insights and forward-looking value.

Based in Asia and open to the world, the journal has developed dis-

tinctive strengths across core mathematical fields. It serves as a platform for global mathematicians to exchange ideas and share achievements, as well as a vital bridge connecting Eastern and Western mathematics and empowering Asian mathematics to reach the international stage.

IJM will continue to nurture young talent, drive academic innovation, and contribute enduringly to the long-term development of global mathematics.

— Bai Chengming, vice president of Nankai University, and a recipient of the National Science Fund for Distinguished Young Scholars

Landmark Yardstick for Embodied AI Released

By Staff Reporters

China has officially released its first industry standard for embodied AI, establishing a unified benchmark testing framework and marking a new phase where embodied AI can now be evaluated.

Drafted jointly by the China Academy of Information and Communications Technology (CAICT) and over 40 other organizations, the standard focuses on key foundational AI technologies and benchmark testing methods for embodied AI, while also clarifying system frameworks and capability requirements. It is scheduled to take effect on June 1.

"Embodied AI is at a critical stage of transitioning from laboratory research to commercial application," said Wei Kai, director of the Artificial Intelligence Institute of CAICT.

According to CAICT data, the number of domestic humanoid robot manufacturers exceeded 140, with over 330 humanoid robot models launched.

However, Wei said that the industry is currently confronted with two major challenges: a "workshop-style" research and development model, and a "fragmented" ecosystem landscape.

The "workshop-style" model relies heavily on the experience of algorithm engineers for model tuning and deployment. This means data is scattered among various collection factories, making integration and reuse difficult. Meanwhile, hardware is often assembled without uniform standards, requiring "nanny-style" maintenance from manufacturers after delivery, hindering large-scale deployment.

The fragmented ecosystem is evident in the strong coupling between model performance and hardware, where a change in components can easily lead to system failure. System capabilities are heavily reliant on the results of scenario-specific training, and a change in environment can easily lead to a malfunction. A lack of uniform standards across the supply chain makes it difficult to replicate technological achievements and leads to low coordination efficiency.

"A trusted evaluation system for embodied AI serves as a bridge connecting technological research with large-scale industrial application," Wei said. "It provides the industry with a unified technical specification framework, establishes a foundation of mutual trust, and

promotes the shift of embodied AI from workshop-style development to industrial development."

On the one hand, the standard helps users distinguish genuine intelligence from technological stunts by verifying a model's generalization ability and deployment effectiveness in real-world scenarios. Companies are therefore encouraged to develop truly scalable and replicable foundation models for embodied AI.

Conversely, the standard clarifies what qualifies as a product, reducing the costs associated with technology selection and adaptation, and optimizing resource allocation across the entire industry chain.

"A comprehensive assessment of the stability and reliability of embodied AI in complex environments can also provide a safety guarantee for large-scale product deployment," Wei said. "More importantly, with this trusted yardstick, all links in the industry chain, from upstream to downstream, have a common basis for collaboration. This enables the effective integration of technology R&D, hardware manufacturing, and scenario application," he added.

The newly released document stan-

dardizes the framework, methods, and metrics for benchmarking embodied AI systems in both simulation and real-world environments. The evaluation system it introduces supports testing of basic capabilities, cognitive reasoning abilities, and full-chain closed-loop capabilities, covering four methods: static simulation testing, dynamic simulation testing, real-environment testing, and combined testing.

"As the first officially released industry standard in the field of embodied AI, the introduction of this benchmark testing method is of great significance for promoting technological progress, application implementation, and industrial development. It charts a clear direction for the industry's growth," Wei said.

Wei also noted that the establishment of an independent evaluation standard will help channel national innovation resources toward directions aligned with China's industrial advantages and technological trajectories.

Furthermore, once the evaluation standard matures and is adopted internationally, it will support the global expansion of Chinese embodied AI products, solutions, and platforms, further cementing the "Chinese model" in this field.

Powerful TBM: Digging Deep into the Earth

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Following a series of computational simulations and adaptations, the team significantly improved uneven wear on the cutting tools and optimized the overall stress distribution. This effectively resolved the challenges posed by deep-earth hard rock.

Removing muck

Once the excavation problems were solved, removing the rubble and excavated soil became the second major hurdle. Removing muck from a 1000-meter-deep shaft is like collecting garbage from the roof of a 300-floor building without a lift, Ding Zhangfei, chief designer of Gangtie Jiliang, said.

Due to the influence of gravity, the excavated soil falls behind the cutterhead of a horizontal TBM, but in front of the cutterhead of a vertical shaft TBM, like Gangtie Jiliang. Excavating muck for the latter is therefore much more difficult.

The research team initially chose

the direct excavation approach, but the technical challenges made it impossible. Inspired by the traditional Chinese chain pump, which lifts water step by step via circulating paddles, the team developed an intelligent vertical muck removal system and installed a 25-meter-long conveying pipe extending into the cutterhead of Gangtie Jiliang.

In practical application, the intelligent vertical muck removal system achieves a removal rate of 120 cubic meters per hour, equivalent to the hourly transport capacity of approximately 10 conventional municipal dump trucks.

At the tail end of the system, the innovative team also developed a ring-shaped muck collection device, enabling 360-degree, dead-angle-free muck collection at the system's rear, and precise transfer to the storage silo, followed by hoisting via a skip to the shaft head for discharge.

Support crucial for excavation

Underground tunnels extending

over a kilometer are often subject to high ground stress and water pressure, while the surrounding rock is highly prone to stress release after excavation. Without timely support, the tunnel walls will deform immediately after excavation, and there is even a risk of collapse.

The research team collaborated with several other research institutes to develop a support system. Three mainstream support schemes — rock bolts and shotcrete, formwork with cast-in-place concrete, and prefabricated steel plates combined with concrete — were systematically evaluated through repeated testing and analysis.

The team conducted a comprehensive assessment of the structural configurations of these three methods, comparing support efficiency, construction convenience, and strength and safety performance, Ding said.

The second option formwork with cast-in-place concrete was selected, but proved unsuccessful.

"We carried out a comprehensive redesign and major upgrades of the cutterhead, stepwise support mechanism, working platform and hoisting system," Ding said. "A supporting structure was installed beneath the formwork, extending outward like multiple 'arms' to hold the cast concrete in place. In addition, a separate suspension system was introduced to lift and position the formwork."

This system operates independently of the TBM cutterhead and other components, allowing support operations to proceed without interfering with excavation. As a result, the formwork remains stationary while the machine advances downward, providing a stable environment for concrete curing, according to Ding.

Looking ahead, Ding said the team will continue advancing key technologies and equipment for kilometer-scale vertical shaft hard-rock full-face TBMs, expanding the application scenarios of Gangtie Jiliang.

U.S. 'Whistleblower' Scheme Hurts Tech Ties with China



By LIANG Yilian & HU Dingkun

Recently, the U.S. House Select Committee on China set up a so-called "whistleblower" reporting channel on its official website. It openly encourages American scholars, researchers, and other professionals to report scientific collaborations involving entities linked to China's defense and industrial base. Responding to the move, Chinese Foreign Ministry spokesperson Mao Ning told a regular press briefing that the committee's efforts to suppress and contain China have reached an almost "hysterical" extent.

This assertion is hardly overstated. On social media, the committee justified its call for reports by citing concerns over "research security vulnerabilities" and the "risks" of cooperation with China. As evidence, it pointed to cases in which faculty members from the University of Washington and Texas A&M University co-authored academic papers with researchers from Chinese institutions listed on the U.S. Department of Commerce's entity list. The implication is unmistakable: the committee seeks to sever ties between U.S. researchers and some of China's most important research institutions already under U.S. sanctions. Even co-authoring academic papers, the most basic form of scholarly exchange, now appears to be enough to



A researcher performs genotyping analysis to identify plant genotypes at a laboratory. (PHOTO: XINHUA)

trigger suspicion and reporting.

Labeling such collaboration as "risks" or "vulnerable" is not only misguided but fundamentally at odds with established norms. U.S. export control regulations themselves include a well-defined "fundamental research exemption," under which research intended for open publication is not subject to such restrictions. By this standard, U.S. researchers are fully permitted to engage in fundamental research and publish jointly with institutions on the entity list. Treating these activities as suspect distorts both the spirit and the letter of existing rules.

History offers a sobering warning. Encouraging the reporting of China-related scientific collaboration risks opening

a "Pandora's box" ultimately undermining the very foundations of the U.S. research system and its innovative capacity.

Between 2018 and 2022, the U.S. government's China Initiative conducted sweeping investigations into large numbers of researchers with China ties. The current reporting system mirrors this controversial program and is likely to worsen its negative impact. A study published in the journal *Proceedings of the National Academy of Sciences* found that the initiative contributed to a significant outflow of scientists of Chinese origin from the United States, with departures up by 75 percent between 2018 and 2021.

Meanwhile, research by the National Bureau of Economic Research indicates that

investigations by the National Institutes of Health into U.S.-China collaboration reduced research output in affected fields, harming not only American science but also global scientific progress.

Equally concerning is the issue of due process. Even with formal investigations conducted by professional judicial bodies, the China Initiative produced a significant number of flawed or unsubstantiated cases. According to *MIT Technology Review*, by the end of 2021 only about one-quarter of defendants under the initiative by the U.S. Department of Justice were convicted. The committee's reliance on peer reporting — without clear safeguards for verification — raises the risk of aggravating errors, inviting false accusations, and placing innocent researchers under unwarranted scrutiny.

The specter of history looms large. Encouraging denunciations echoes the damage inflicted on the scientific community during McCarthyism in the 1950s. Baseless allegations of political disloyalty disrupted careers and stalled scientific progress, affecting prominent figures like Elvin A. Kabat and J. Robert Oppenheimer. While many accusations were later proven unfounded, the long-term damage to the U.S. research environment proved difficult to reverse.

Ultimately, promoting the reporting of China-related scientific collaboration risks self-inflicted harm. Rather than strengthening national security, it could erode trust, stifle openness, and weaken the very innovation ecosystem it seeks to protect.

China's AI Ecosystem Wins Over Young Experts from Europe

Opinion

By GONG Qian

A group of young international experts from the UK, Austria and the Netherlands took part in an exchange event hosted by the World Association of Young Scientists (WAYS) from April 11 to 17. They visited Beijing and Huai'an in Jiangsu province in east China, toured a number of sci-tech institutions and enterprises, and held in-depth discussions on topics including AI, new materials and biomedicine.

Three participants from the Netherlands shared their observations on China's sci-tech innovation ecosystem with *Science and Technology Daily*.

Outstanding advantages in AI development

In recent years, China's AI industry has been on the fast track with many achievements, particularly DeepSeek taking the world by storm. Friso H. Smedes from the University of Groningen,

Mohammed Ali from Vrije Universiteit Amsterdam, and Petter Reijalt from Delft University of Technology said they use DeepSeek for research due to its effectiveness and favorable price.

In Beijing, they visited Kuaishou, one of China's most popular short-video and streaming platforms, where they could watch up close AI development in China. Ali and Smedes were impressed by the company's video generation model that can create complete movies. They were also impressed by its growing scale with over 10,000 employees based in Beijing.

Ali said this size is rarely seen in regular AI companies in the Netherlands, where only oil companies might have such a large workforce. He pointed out that government support is a clear advantage for the rapid AI growth in China. He also emphasized China's 1.4 billion population, with its high number of PhD holders, provides abundant human resources for AI research and innovation.

Reijalt took note of China's massive data centers and computing power supported by a large number of GPUs. Infrastructure such as the large-scale data

centers built by Alibaba, one of China's tech giants, is easily accessible. But that's not the case in his own country.

A well-integrated and supportive ecosystem

Observing a well-integrated system after visiting universities in Huai'an, Smedes said China's sci-tech innovation is "definitely going fast." Here, if a student comes up with an idea, the student can take courses at the AI faculty and try to develop projects.

This interdisciplinarity, combined with a friendly entrepreneurial environment — where people can start companies at universities and receive funding and even housing support — forms a promising ecosystem, he said.

Reijalt was also impressed by China's approach to nurturing talent and its supportive digital cooperation, utilizing digital technologies to drive industrial upgrading and promote the synergistic development of digitalization and green initiatives, thereby achieving sustainable development.

Exchanges foster cooperation

Ali and his team are developing an

AI program for medical triage, designed to assist doctors by automating appointment booking and symptom inquiry through online chat or voice AI. He presented a roadshow in Huai'an to expand his network and understand the local market, and expects to explore cooperation opportunities with Chinese companies.

He stressed that greater communication is essential for deepening sci-tech exchanges among young talents from Europe, the U.S., and China. Young researchers should talk about the challenges they face and the solutions they propose, identify shared concerns, and conduct joint research. Collaboration will accelerate research and development progress compared to working separately.

Reijalt said exchange programs lower barriers for international cooperation by helping participants get to know each other. During the visit, he connected with researchers from Hong Kong and found potential cooperation opportunities. A mix of formal and informal activities, he emphasized, helps strengthen technological exchanges.

Senegal will host the 4th Youth Olympic Games in October-November, the first Olympic event on the African continent. "In our preparations, many Chinese companies are collaborating with Senegal — for instance, Alibaba is providing extensive cloud services for the event," Sall said.

Adrian Thomas, minister of tourism, creative economy and culture of Grenada, emphasized that for developing countries like Grenada, and indeed the entire Caribbean region, digital empowerment is particularly crucial for high-quality development. He commended China's contributions to the development of the Caribbean and the Global South, and China's provision of technical training and assistance in infrastructure construction.

Quoting the proverb, "If you want to go fast, go alone; if you want to go far, go together," Thomas called for unity and cooperation within the Global South to jointly accomplish the digital transformation.

Voice of the World

Chinese Humanoid Robots Boost Global Industrial Progress

Edited by QI Liming

"Flash," Shenzhen Honor Smart Technology Development Co., Ltd.'s humanoid robot capable of autonomous navigation, claimed victory at the 2026 Beijing E-Town half-marathon on April 19, with a time of 50 minutes and 26 seconds. It surpassed the human world record for a half-marathon by nearly seven minutes.

Such amazing performance on the track is a vivid example of the breakthroughs made by China's humanoid robot industry in multiple core technologies. Chinese humanoid robots are rapidly evolving in real-world applications and China now leads the global robot industry.

In this marathon, robots with fully autonomous navigation accounted for approximately 40 percent of the starting teams, a significant increase compared to last year. Some of the high-performing robots have achieved body tilting and smooth curve changes under high-speed conditions.

"It will certainly be interesting to see the progress in the durability of components and battery lifetime compared to last year," said Georg Stieler, Asia managing director and head of robotics at Stieler, a technology consultancy.

China has made significant breakthroughs in the control technology of humanoid robots, especially in autonomous motion control and stability.

Flash has been designed after elite athletes, with its long legs measuring about 37 inches. It also has an advanced cooling system to sustain performance.

"Looking ahead, some of these technologies might be transferred to other areas," said Du Xiaodi, an engineer with the Honor team. "For example, structural reliability and liquid-cooling technology could be applied in future industrial scenarios."

Fu Yili, a professor of Harbin Institute of Technology, attributed the leap



A humanoid robot runs during the E-Town half-marathon on April 19. (PHOTO: ZHAO Weihua / Science and Technology Daily)

from "remote-controlled waddling" to the "autonomous running" of humanoid robots to the joint efforts of hardware localization, algorithm optimization, and the development of the industrial ecosystem.

From a global perspective, China leads in terms of overall machine shipments, production capacity, supply chain completeness, and the speed of commercialization. It has become the "mass production and application center" of humanoid robots.

China dominates global humanoid robot installations, accounting for more than 80 percent of the 16,000 units installed worldwide in 2025, according to global technology market intelligence firm Counterpoint Research. Chinese robotics firms are now working to develop the AI software needed for humanoids to match the efficiency of human factory workers.

London-based technology research and advisory group Omdia recently ranked three Chinese companies — AGIBOT, Unitree Robotics and UBTECH Robotics Corp. — as the only first-tier vendors in its global assessment for shipment numbers for general-purpose embodied intelligent robots. They all shipped more than 1,000 units of such robots last year, with the first two shipping more than 5,000 units, the report said.

The expansion of industrial scale implies an increase in the influence of technology. Yang Zhen, an associate research fellow of the Institute of Industrial Economics of the Chinese Academy of Social Sciences, said China is not only the world's largest producer of robots, it has also become an important source of technology.

The number of Chinese patents and enterprises account for over 60 percent of the global total. In the cutting-edge field of humanoid robots, Chinese enterprises' performance is almost "dominant."

The autonomous humanoid robot player Flash crosses the finish line in the E-Town half-marathon on April 19. (PHOTO: XINHUA)



Advancing Cooperation Under GDI

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"China is committed to building a community with a shared future for mankind, and making the global early warning system under the framework of meteorological disaster prevention and mitigation benefit more developing countries, especially those in the Global South," Zhang said.

The sub-forum also announced that CIDCA, CMA and the World Meteorological Organization (WMO) signed a memorandum of understanding on promoting the implementation of the GDI.

Celeste Saulo, WMO secretary-general, said in her address at the opening ceremony that China has demonstrated strong leadership in early warning. By working with other developing countries across regions and with WMO support, China is helping to provide early warning systems as a global public good.

"These are exactly the types of partnerships we need."

China has also been advancing international cooperation under the GDI framework in the digital sector.

Zhao Fengtao, vice chairman of CIDCA, said at another parallel sub-forum, development cooperation projects — ranging from fiber-optic backbone networks, e-government systems, and data centers to smart transportation — have been launched in nearly 20 countries and regions to strengthen digital infrastructure.

"These initiatives have injected new momentum into the economic and social development of the participating nations."

In digital sectors such as information and communications, intelligent manufacturing, and green development, over 500 human resources training programs

have been conducted. These efforts have cultivated more than 15,000 professionals for developing countries, helping to alleviate talent bottlenecks in the digital field.

Sengdeun Sayasone, executive vice chairman of the Laos-China Cooperation Committee of Laos, said digital empowerment is not merely a technical issue, but a transformation of development models. Laos and China will deepen digital cooperation, utilizing digital technologies to drive industrial upgrading and promote the synergistic development of digitalization and green initiatives, thereby achieving sustainable development.

Alioune Sall, minister of communication, telecommunications and digital affairs of Senegal, said, China's digital development model possesses distinct advantages and offers Senegal significant insights. The partnership between Senegal and China is robust and development-oriented, and the bilateral cooperation is both close and pragmatic.

AI Weather Alert System for BRI Countries

From page 1

To be deployed in six countries and operate stably for more than six months, the project is expected to provide meteorological disaster warning services to approximately 10 million people. A joint laboratory will be established to help BRI partner countries build their local meteorological science and technology capabilities.

The project's core AI models will be integrated into MAZU, the meteorological early warning business platform al-

ready in use in countries such as Pakistan and Ethiopia, and relying on this mature technical foundation, systematic services will be provided to BRI partner countries.

This project is jointly implemented by nine domestic institutions and universities including Lanzhou University, Renmin University of China and the National Climate Center, as well as meteorological departments and research institutes from five BRI partner countries, namely Mongolia, Ethiopia, Cameroon, Tajikistan and Uzbekistan.

4

LIFE IN CHINA

Voyage to Build China's Cruise Dream

Dialogue

By LONG Yun & BI Weizi

The docks of Shanghai are a long way from the Adriatic Sea. But that is exactly where Marco Rovati, a Croatian cruise ship expert with 30 years of European experience, chose to drop anchor.

"Coming to China to oversee the construction of China's homegrown cruise ships was the most correct decision in my life," he told *Science and Technology Daily*.

Decision forged by determination
What attracted him away from a successful European career? Not money but potential and sincerity. For decades, China had aspired to the "jewel in the crown of the shipbuilding industry," the large cruise ship. But unlike other nations, "China didn't just have dreams. It acted," Rovati said.

When CSSC Cruise Technology Development Co., Ltd. (CCTD) invited him to participate in the Adora Magic City project, he witnessed a "firm determination" unseen in most European shipyards. Nearly 6,000 researchers from more than 40 domestic units were mobilized to tackle the core technologies bottlenecks.

"This kind of national-level attention and industrial potential is unmatched in many European countries where the cruise ship industry was in a stagnant state at that time," he explained.

Croatia has a rich maritime tradition and Rovati had to adapt his management style to China's unique working culture. He noted that unlike the relatively independent work mode in Europe, Chinese teams emphasize "close collaboration and efficient execution."

Instead of simply imposing international standards, he integrated his experience with local realities, establishing a multi-level, distributed dynamic management system to break down the colossal project into manageable modules.



Marco Rovati. (COURTESY PHOTO)

Witnessing 'Chinese speed'
A large cruise ship consists of over 25 million parts. For Rovati, the single biggest challenge regarding the Adora Magic City was the integration of thousands of systems, particularly addressing three world-class technical difficulties: vibration and noise reduction, weight control, and safe return-to-port capability.

In the joint technical team he guided international standards while Chinese engineers tackled key bottlenecks. Through day- and- night labor, they achieved seamless integration.

What truly stunned the veteran expert was "Chinese speed." Rovati gave a specific, quantifiable example.

The second domestic ship, the Adora Flora City, is larger than its predecessor, the Adora Magic City. Its atrium is 17.4 meters longer, requiring higher structural strength. Yet its total construction cycle has been shortened by eight months.

"According to the international conventional construction cycle, the construction period of the second ship should be similar to (the first ship's) or even longer," Rovati said. Instead, the ship is now 85 percent complete, with delivery expected by

the end of 2026.
He pointed to the prefabricated cabin process as the key: The Chinese team optimized international methods, prefabricating over 1,100 cabins as independent units in a factory before integrating them into the hull. During a critical period, the team completed a task scheduled for three months in just one month.

"This kind of efficiency, which combines diligence, professionalism, and team collaboration, is the true 'Chinese speed' in my eyes," he said.

Mission beyond ships
Rovati's mission is not only to oversee the construction of two ships. It is to build capability. He said his proudest achievement was watching the Chinese on-site supervision team on the Adora Flora City achieve independent technical review for the first time.

Today, an 18-member supervision team is independently solving technical problems, from structural optimization to system debugging. "Their growth means that China has initially established an independent technical supervision system for large cruise ships," he said.

What principles is he trying to pass on? Three things: respect for details,

First Ascendable Pagoda in the World

Traditional Eastern Wisdom

By BI Weizi

The Yongning Temple Pagoda is an iconic landmark in Luoyang, Henan province in central China, originally constructed in the first year of the Xiping era (516 CE) during the Northern Wei Dynasty. It was a site where the Emperor and the Empress Dowager performed Buddhist rites.

Modeled after the Cakri Stupa, the preeminent stupa of the Western Regions, the Yongning Temple Pagoda rose to a height of 49 *zhang* (approximate

ly 136.71 meters). When combined with its spire, its total height reached 153.31 meters. It was the tallest wooden high-rise structure in ancient history, rivaling the so-called "Seven Wonders of the World" compiled by the Western world.

The Yongning Temple complex was designed with the pagoda at its center, surrounded by the monks' quarters arranged in a concentric ring. It was the first Buddhist temple in China to adopt a fully Sinicized architectural style.

The pagoda featured a gateway on each of its four sides. The southern gate was a three-storied structure connected by three elevated walkways. Standing 20 *zhang* above the ground,

it bore a structural resemblance to the Duanmen (Front Gate) of the Imperial Palace.

Its surface was decorated with swirling cloud motifs and painted celestial spirits featuring intricate patterns of colorful brocade and azure latticework of dazzling brilliance. The arched doorways were flanked by statues of four Vajra guardians and four lions, lavishly embellished with gold and silver, and adorned with pearls and jade, creating a spectacle of solemn grandeur and resplendence unparalleled in the world at that time.

Green Huai trees were planted outside each of the four gates, and a moat of clear water encircled the entire com

plex. This environment, with the Yongning Temple nestled amongst water and trees, effectively screened the complex from the dust and grime kicked up by passing traffic.

Unlike early pagodas in the ancient world, which were typically inaccessible to visitors, the Yongning Temple Pagoda ingeniously fused the ancient Indian stupa tradition with the Chinese architectural style of multi-storied pavilions. This resulted in the creation of the world's first ascendable pagoda — a monumental technological breakthrough in architecture that held profound significance as a pivotal link between past traditions and future developments.

While these three terms are often used interchangeably, their core areas of focus are distinct: GIA focuses on solving a wide range of problems just like a human (scope of capability); EAI focuses on interacting with the world through a physical body (cognitive modality); and humanoid robots focus on resembling humans physically (form).

For the first, it should be borne in mind that on a ship with 25 million parts, a one-millimeter deviation in thin steel plate welding can affect the entire weight balance.

On innovation, he said while learning from abroad is vital, the Chinese team's optimization of prefabricated cabin technology and digital twins is the real victory.
Finally, he reminds his young colleagues that a cruise ship carries thousands of lives. "This is not just a job, but a commitment to safety and trust."

A second home
With the Adora Magic City already serving over one million tourists and achieving a passenger satisfaction rate of over 95 percent, Rovati is ambitious for the next decade. He predicts China will evolve from an "industry latecomer" to a "core force" and "leader" in the global cruise industry.

He cited the massive domestic market potential, expecting annual throughput to exceed five million passenger trips in the 14th Five-Year Plan period (2021-2025), making China the world's second-largest cruise market.
Personally for him, China is no longer just a workplace. He calls it his "second home." "I have witnessed the great changes in China's cruise industry from 'zero' to ranking among the world's cruise shipbuilding countries," Rovati said. "I have also formed deep friendships with Chinese colleagues."

What keeps him motivated? The rapid development and growth of his team. Every time he sees the steady progress of the Adora Flora City or a young member make a breakthrough, he feels his efforts are worthwhile.

"I hope to continue to stay here, act as a bridge for Sino-foreign technical cooperation and talent exchange, and witness China's cruise ships sail as a shining business card of China's high-end manufacturing industry."

HAO Xueying and HUI Shengyao from CCTD also contributed to this article.

Tech+Culture

Modern Astronomy Shaped by Ancient China's Cosmic Legacy

By Staff Reporters

Ancient Chinese astronomy was rooted in classical tradition yet continuously refined through observation over thousands of years — a development that evolved through inheritance and innovation. Key practices included gnomon shadow measurements, geodetic surveys conducted by Yi Xing (683-727 CE), a Buddhist monk and astronomer, and Guo Shoujing (1231-1316 CE), an astronomer of the Yuan Dynasty. Detailed records of celestial phenomena were also well maintained.

From observing the sky to issuing the calendar

Observing the stars served a primary purpose — to "grant the seasons," or shoushi. An early Chinese text recounts Emperor Yao instructing his astronomers: "A solar year has 366 days. Use the intercalary month to fix the four seasons and complete the year." This describes the lunisolar calendar. The astronomer and historian Chen Zungui (1901-1991) considered this to be the earliest documented lunisolar calendar in China. It established the basic structure of Chinese calendars for centuries, using the lunar synodic month as the month and the solar tropical year as the year.

However, as observational data accumulated, older calendars eventually fell out of sync with actual celestial phenomena. This affected farming and rituals, meaning calendars had to be constantly revised.

In 104 BCE, Emperor Wu of Han (reigned 141 – 87 BCE) ordered a calendar reform. Astronomers redetermined the synodic month and calculated the tropical year as 365.25016 days.

In the Tang Dynasty (618-907 CE), Yi Xing remeasured shadow lengths across the country and developed new mathematical methods for his calendar, completed in 728 CE. In the Yuan Dynasty (1271-1368 CE), Guo Shoujing determined the tropical year to be 365.2425 days for his calendar, introduced in 1281 CE. This value was remarkably close to modern measurements.

By the Qing Dynasty (1644-1912 CE), a new calendar adopted in 1645 CE, incorporated Western astronomical theories but did not abandon the lunisolar structure. It improved accuracy within the existing framework.

From gnomon shadow to geodetic survey

An ancient Chinese text describes how astronomers placed an eight-chi gnomon, approximately 1.8 meters tall, vertically on the ground. At noon on the summer solstice, if the shadow measured exactly one chi and five cun, approximately 0.35 meters, that location was considered the center of the earth.

Another early text, compiled roughly between the 4th and 1st centuries BCE, used mathematical methods such as the Pythagorean theorem to calculate cosmic distances. It proposed that the distance between heaven and earth was 80,000 li, approximately 40,000 kilometers.

As territory expanded, astronomers found that shadow length changes did not conform to the simple linear formula assumed in that text. In the Sui Dynasty (581-618 CE), the scholar Liu Zhuo (c. 544-610 CE) requested a nationwide geodetic survey to verify the formula, but his request was not granted.

Yi Xing later completed such a survey. In 724 CE, he and his colleague, an astronomer of the Tang court, measured the North Star's altitude and solstice shadows at multiple locations from north to south. They concluded that the old formula was wrong.

During the Yuan Dynasty, Guo Shoujing improved the gnomon by designing a high gnomon, approximately 12 meters tall. He also invented an auxiliary device to reduce measurement errors caused by the blurring of shadows. This high gnomon can still be seen today at the Dengfeng Observatory in Henan province, located a short distance from an older gnomon platform.

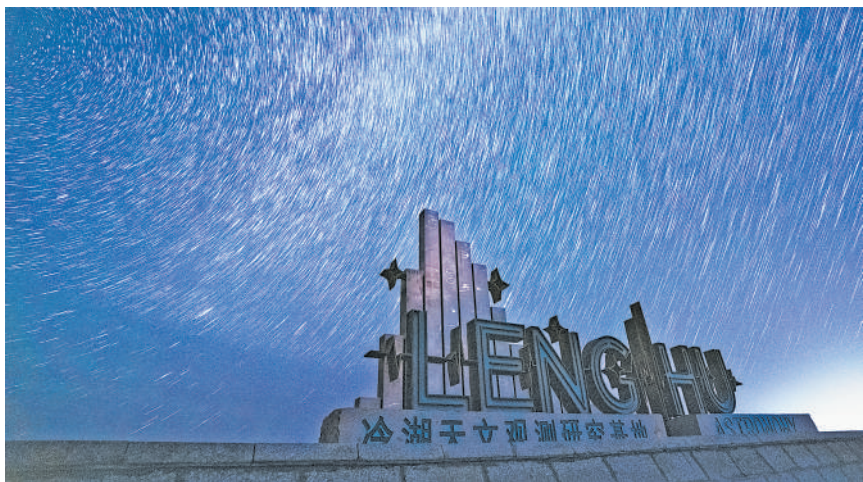
Modern relevance of ancient astronomy

Ancient Chinese observational records offer valuable insights for modern astrophysics. The astronomer and historian Xi Zezong (1927-2008), an academician of the Chinese Academy of Sciences, examined ancient records of "guest stars," or kexing, which were supernovae, in the 1950s. He compiled a catalog of ancient novae, which helped Chinese and international astronomers confirm that the Crab Nebula in Taurus originated from a supernova explosion in 1054 CE, which was recorded in Chinese texts as the "Tian Guan guest star."

Unlike ancient Greek astronomers, who were mostly private philosophers, the chief astronomer in ancient China, known as the Grand Astrologer, held a ministerial-level position. This institutional support enabled large-scale observations. However, nationwide surveys such as Yi Xing's were only possible when the state was powerful enough to fund them. During the Tang Dynasty, Emperor Xuanzong (reigned 712-756 CE) generously supported Yi Xing's work. The resulting calendar assisted the emperor to govern more effectively, ultimately benefiting both their respective fields.

Modern astronomy still depends on strong national support. China's Chang'e lunar missions and the Tianwen Mars exploration program are recent examples. The experience of ancient Chinese rulers who supported large-scale astronomical research may still offer valuable lessons today.

Ancient Chinese astronomy engaged uniquely with classical tradition. That path began with the lunisolar calendar and gnomon shadow measurements, giving Chinese astronomy a strong classical and humanistic character. Through tool innovation and methodological breakthroughs, ancient scholars continuously revised the relationship between heaven, earth, and humanity.



The starry sky near the Lenghu astronomical observatory in Lenghu town, Mangnai city of Haixi Mongolian and Tibetan autonomous prefecture of northwest China's Qinghai province. (PHOTO: XINHUA)

GIA, EAI and Humanoid Robots?

Science Outreach

By Staff Reporters

At the 2026 Beijing E-Town Humanoid Robot Half Marathon, which finished on April 19, over 70 robots took part, and they all won hearts in different ways. Some impressed with raw speed and technical skill; some

won with their cuteness. Even those that were clumsy and stumbled through the course made the spectators cheer even louder.

These developments have brought concepts such as general-purpose intelligent agent (GIA), embodied artificial intelligence (EAI) and humanoid robots into the spotlight. But what exactly is the difference between them?

GIAs have an omniscient AI brain capable of independently identifying and solving problems.

It is an intelligent agent able to

perceive, think, make decisions, learn, execute tasks and collaborate independently, while also understanding human emotions and adhering to ethical and moral principles — much like a human. Tongtong is a practical example of GIA.

However, Tongtong currently exists solely in the digital realm of screens and cannot physically interact with the real world. EAI is the key to breaking down this screen barrier. It refers to AI that possesses a physical body. Rather than being a mere "pa-

per strategist" trapped within a screen and offering advice solely through speech, it is a "doer" that can truly step into the real world.

A humanoid robot is an advanced form of intelligent robot with a human-like physical appearance that is better adapted to human environments.

While these three terms are often used interchangeably, their core areas of focus are distinct: GIA focuses on solving a wide range of problems just like a human (scope of capability); EAI focuses on interacting with the world through a physical body (cognitive modality); and humanoid robots focus on resembling humans physically (form).