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Special Issue on the 2023 International Science and Technology Conference Agenda Guidelines

Headlines

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CAST organizes press conference in Beijing to release the 2023 International Science and Technology Conference Agenda Guidelines

Press conference to unveil the Guidelines
Photo credit: China Centre for International Science and Technology Exchange

On May 25, 2023, the China Association for Science and Technology (CAST) held a press conference in Beijing to formally introduce the 2023 International Science and Technology Conference Agenda Guidelines. Representatives from the Chinese Association for Artificial Intelligence (CAAI), the Chinese Nuclear Society (CNS), and the Chinese Society of Microcirculation (CSM) were present to deliver updates on preparations for several upcoming conferences scheduled to be held in China including the 2023 Global Artificial Intelligence Technology Conference (GAITC 2023), the 6th China (International) Conference on Nuclear Power Instrumentation & Control Technology, and the 12th World Congress of Microcirculation (12th WCM).

The Guidelines, designed to pinpoint emerging technological frontiers and address existing innovation gaps, was crafted to stimulate international scientific exchange among professionals in the field. They were collaboratively assembled in March by the National Research Center for Frontier Technology Integration and Innovation at the University of the Chinese Academy of Sciences (UCAS), the Centre for Innovation and Development (CID) of the Chinese Academy of Sciences (CAS), and the Chinese Association of Science of Science and S&T Policy Research (CASSSP), under the guidance of the CAST International Cooperation and External Liaison Committee. The Guidelines addresses 55 topics spread across four groups, highlighting frontier technologies, technologies driving socio-economic growth, and a variety of interdisciplinary domains.

CAST's role in facilitating and endorsing international science and technology conferences has served as a cornerstone for promoting academic discourse and scientific collaboration within China. Such platforms inspire a spirit

of openness, trust, and cooperation in the global scientific community. The topics chosen for these conferences are crucial in guiding the focus of the global tech community towards key issues and fostering meaningful conversations and partnerships. Selecting topics that resonate with the current global challenges reinforce these conferences' impact on addressing the Sustainable Development Goals, bolstering global economic and social growth, and spurring the creation of groundbreaking scientific and technological knowledge. Moreover, the events enhance public understanding and aid in establishing a universal consensus on pivotal science and technology governance issues.

(Source: Official WeChat account of the China Centre for International Science and Technology Exchange)

Cover Story

Design approach for the 2023 International Science and Technology Conference Agenda Guidelines

At the press conference, Mu Rongping, member of the CAST International Cooperation and External Liaison Committee, head of the Guidelines expert group, and Director-General of the CAS Center for Innovation and Development (CID), laid out the design principles that underpin the Guidelines for those in attendance.

Mu Rongping and his team crafted the Guidelines following extensive analysis of various data and expert opinions. They started the process with data collection followed by sorting, integration, and comprehensive analysis before creating a checklist. The team engaged in a thorough review of topics discussed at international science and technology conferences organized by leading global institutions. Furthermore, they explored the future technology directions suggested by internationally recognized scientific and technological organizations and societies. They also considered the most recent research trends from well-known institutions both within China and globally and the subjects of papers from leading international science and technology journals. Furthermore, the team carried out surveys, consulted with scientists across different disciplines, and organized expert discussions on significant topics.

The team subsequently refined their study by examining popular themes at international science and technology conferences within China, major global science and technology governance issues, and potential future development areas. They cate-

gorized the shortlisted topics into four groups. The Guidelines was finalized after comprehensive discussions with professional organizations.

Designed to serve as a roadmap for international science and technology conferences, the Guidelines was divided into four key groups. The first group highlights 11 topics related to the United Nations 2030 Agenda for Sustainable Development. The second addresses 26 topics regarding technologies that drive new patterns of development. The third covers 9 topics concerning knowledge production, future technology, and public understanding of science. The fourth delves into 9 topics related to global scientific and technological governance.

(Source: *Science and Technology Daily*)

2023 International Science and Technology Conference Agenda Guidelines (Excerpt)

In March 2023, the Department of International Affairs of CAST developed the Guidelines for the upcoming international science and technology conferences scheduled in China in 2023, in consultation with the CAST International Cooperation and External Liaison Committee. The following topics are presented in the Guidelines.

Group 1 Key topics aligned with the United Nations 2030 Agenda for Sustainable Development

◎ Green and low-carbon technology for climate change

Key areas of focus include renewable synthetic fuel technology, clean transportation technology, carbon capture, utilization, and storage technologies, green ammonia synthesis, carbon dioxide removal technology, and ocean ecosystem carbon storage technology.

◎ Real-time monitoring of air pollution prevention and control

Key areas of focus include integrated monitoring and early warning technology for air and land, efficient treatment technology for smoke pollutants, causes and prevention of atmospheric haze, precise coupling technology of climate evaluation models and air quality models, and interdisciplinary integrated

assessment models for energy economy-air quality-climate health.

◎ Observational systems for sustainable development

Key areas of focus include Earth big data, remote sensing monitoring, marine meteorological observation, ecological and environmental monitoring systems, carbon monitoring systems, cloud computing, and high-performance computing.

◎ Emerging technologies for smart cities

Key areas of focus include the Internet of Things (IoT) technology, smart dust, intelligent building technology, smart water management technology, intelligent transportation technology, smart healthcare technology, and smart elderly care technology.

◎ Clean and efficient utilization of fossil fuels

Key areas of focus include ultra-supercritical power generation technology, near-zero emission coal-based clean fuels and chemicals, heavy-duty gas turbines and efficient gas engines, circulating fluidized bed combustion technology, pulverized coal pressurized gasification technology, coupling technology of low-rank coal grading liquefaction and Fischer-Tropsch synthesis, and efficient catalytic distillation technology.

◎ Renewable energy and new power systems

Key areas of focus include deep integration technology for renewable energy and fossil fuels, application of artificial neural networks in the field of new power systems, optimization of new power system paths, large-scale renewable energy multi-energy complementary system technology, comprehensive utilization of deep-sea and offshore marine energy technology, and technology for distributed renewable energy integrated cooling, heating, and power supply systems.

◎ Frontiers in green agricultural technology

Key areas of focus include technology for recycling agricultural resources, water-saving and high-yield production techniques for wheat, emission reduction techniques for crop and livestock farming, development of green crop varieties, comprehensive and efficient production techniques for vegetables, and advanced technologies for preventing and controlling heavy metal

pollution in arable land.

◎Key technologies to improve food security

Key areas of focus include whole-genome selection techniques for crops, the environmental regulation network from crop genes to phenotypes, advanced manufacturing techniques for large-scale integrated smart farming machinery, intelligent environmental control technology, plant genome editing techniques, and manufacturing of core sensing components for agricultural sensors.

◎Sustainable development of marine ecosystems

Key areas of focus include marine biodiversity conservation, health indicators and marine ecosystem assessment methodologies, predictive models for marine ecosystem dynamics, early warning systems for marine ecological emergencies, assessment of global climate change impact, and disaster risk reduction technology for marine environments.

◎Water environmental protection and ecological restoration

Key areas of focus include regulatory technology for surface water management, implementing large-scale projects using water environment restoration technology, ecological integration of wastewater treatment facilities, automating surface water quality monitoring systems, watershed ecological restoration and functional recovery, smart water management systems, comprehensive green emission reduction and water pollution control technology, zero-discharge wastewater treatment technology, and innovative resource utilization technology.

◎Biodiversity conservation and ecosystem accounting

Key focal points include the global biodiversity framework, analysis of the impact of human activities on biodiversity and ecosystems, ecosystem sustainability, measuring gross ecosystem product (GEP), ecosystem accounting and assessment methodology, and creating efficient ecological conservation networks.

Group 2 Key topics in new areas and arenas of development

◎Advanced nuclear energy technology

Key areas of focus include key technical issues in uranium extraction from seawater, Generation V nuclear energy, disposal of radioactive waste, new approaches to laser nuclear fusion, manufacturing technology for desktop-sized miniature reactor batteries, and modular small reactor technology.

◎Diversified applications of hydrogen energy technology

Key areas of focus include advanced hydrogen production technology, large-scale, energy-efficient liquid hydrogen technology, long-distance green hydrogen storage and transportation technologies, high-reliability and low-energy-consumption hydrogen compressors, key technologies for solid oxide fuel cells, and accident prevention, control, and emergency response equipment for hydrogen combustion incidents.

◎Large-scale energy storage technology

Key areas of focus include large-scale integrated energy storage and application technology, distributed energy storage technology and system optimization, technology for compressed air energy storage, flywheel energy storage, superconducting energy storage, various energy storage technologies such as lead-acid batteries, lithium-ion batteries, sodium-sulfur batteries, flow batteries, variable-speed pumped-storage energy technology, large-scale novel compressed air energy storage technology, various new material preparation technologies for chemical energy storage, high-temperature superconducting magnetic energy storage technology, and flywheel energy storage technology.

◎Next generation COVID-19 vaccines and medications

Key areas of focus include the mutations and evolutionary patterns of the COVID-19 virus, the human immune response to COVID-19 infections, post-COVID-19 complications and recovery, development and delivery systems for mRNA vaccines, broad-spectrum COVID-19 vaccines, broad-spectrum neutralizing antibodies, antiviral small

molecules and peptide drugs, and immune modulators.

◎Future seeds, genetic breeding, and smart breeding

Key areas of focus include intelligent design of crop genomes, artificial intelligence breeding platforms, future seed gene banks, cell engineering breeding technology, genetic engineering breeding technology, and molecular marker breeding technology.

◎ Brain-computer interface technology and brain-like technology

Key areas of focus include paradigm encoding technology, decoding algorithm technology, peripheral device technology, systemization technology, analog and digital chip technology, brain state detection technology, non-invasive brain signal acquisition technology, ear canal electroencephalogram (EEG) collection technology, neural signal stabilizer technology, and external interaction technology.

◎ Digital empowerment of biotechnology and bioeconomy

Key areas of focus include new functional enzyme design technology, green biomanufacturing technology, AI prediction of protein structures, key technologies in bioinformatics, artificial synthetic biological systems, novel protein drug development, and biocomputing.

◎ Biometric recognition and human augmentation technology

Key areas of focus include multimodal biometric recognition technology, genetically modified biosensors for simulated robotic organisms, bioprinting and xenotransplantation technology, DNA-based data storage technology, deepfake and adversarial attack techniques, and generative adversarial network technology.

◎ Plant immune regulation and animal disease prevention and control technologies

Key areas of focus include plant immunity inducers, intelligent diagnosis technology for livestock and poultry diseases, diagnostic and preventive technology for zoonotic diseases, immune signaling pathways, animal disease surveillance and epidemiological networks, and animal and plant gene editing technology.

◎ Artificial intelligence algorithms and computing power

Key areas of focus include artificial intelligence, edge computing, high-performance computing, privacy-preserving computation, quantum computing, neural network deep learning algorithms, large-scale pre-training models, foundational models, microservice architecture, and natural language processing.

◎ Quantum information technology and quantum networks

Key areas of focus include quantum internet, quantum communication, quantum sensing, quantum networks, quantum simulation, quantum cryptography, quantum computing, and quantum measurement.

◎ The Metaverse and Web3 technology

Key areas of focus include blockchain, virtual reality, augmented reality, mixed reality, 5G/6G networks, holographic imaging, Web3 technology, databases, digital identities, distributed networks, Internet of Things (IoT), and digital twins.

◎ Generative artificial intelligence

Key areas of focus include multimodal artificial intelligence, explainable generative artificial intelligence, personalized language generation techniques, generative pre-trained transformer (GPT) models, and model-based computing systems.

◎ Advanced machine tool technology and intelligent manufacturing

Key areas of focus include metal cutting machine tool technology, metal forming machine tool technology, CNC machine tool technology, five-axis linkage technology, bearing technology, precision machining technology, CNC lathe technology, vertical machining centers, sensing and detection technology, manufacturing software, artificial intelligence, and machine learning.

◎ Intelligent manufacturing technology and modern industrial systems

Key areas of focus include additive manufacturing, intelligent workshop and factory construction technology, cloud platform technology, intelligent sensing technology, smart supply chain technology, automatic control systems, and industrial software.

◎Advanced robotics technology

Key areas of focus include flexible robotics technology, conversational intelligent interaction technology, system integration technology, servo motor technology, reducer technology, controller technology, motion control technology, and high-performance servo drive technology.

◎ General aviation equipment and drones

Key areas of focus include aviation engines, UAV technology, electromechanical systems, avionics systems, flight control systems, onboard equipment for general aviation aircraft, and unmanned aerial vehicles.

◎ Deep space exploration

Key areas of focus include deep space orbit design and optimization, space transportation, deep space measurement and control communication, integrated design of horizontal takeoff and landing combined power carriers, high-precision intelligent navigation for unmanned space vehicles, investigation, defense, and development of near-Earth small celestial bodies, deployment, assembly, and construction of large-caliber satellite antennas in orbit, and lunar and space development.

◎Deep Earth exploration and earth monitoring

Key areas of focus include construction of a digital Earth and Earth big data system, geological evolution and cycling of Earth materials, the mechanisms causing major earthquakes and their physical prediction methods, and deep Earth exploration methods.

◎ Deep-sea exploration

Key areas of focus include the manufacturing and security technologies of deep-sea navigation equipment, deep sea exploration techniques, underwater observation networks, and in-situ exploration devices for the deep sea.

◎Frontiers in advanced materials

Key areas of focus include nanoenzymes, nanoscale particle mega-databases, nanobiomaterials, aerospace composite materials, high-end rare earth functional materials, high-performance alloys, high-performance ceramics, high-perfor-

mance fibers, polymer materials, and 3D printing materials.

◎ Intelligent chemistry and digitalization of chemistry

Key areas of focus include chemical reaction databases, prediction of molecular properties, prediction of chemical reactions, machine learning, computational modeling, and simulation.

◎ Frontiers in bionics engineering

Key areas of focus include bionic olfactory and gustatory sensors, bionic materials and micro-nano systems, bionic repair of hard tissues, wearable flexible exoskeletons, intelligent bionic navigation technologies, bionic robotics, bionic materials manufacturing, bionic medicine, and bioengineering technology.

◎Frontiers of new drug development

Key areas of focus include the discovery of actionable drug targets, gene-based drug development, development of novel protein-based drugs, development and design of new disease models, application of micro-nano technology in new drug development, digital therapeutics, research of new medicinal materials, and using AI in the design, simulation, screening, and evaluation of new drugs.

◎Frontiers of artificial synthesis

Key areas of focus include synthetic cells, artificial multicellular systems, and artificial microbiomes; artificial synthesis of DNA; artificial design and synthesis of new cell types; development of large-scale, high-throughput automated screening systems, theoretical models and precision design of artificial synthetic biological systems, and carbon dioxide synthesis into starch.

◎ New energy vehicles and green transportation

Key areas of focus include critical technologies for new energy vehicles, intelligent connected vehicles, digital transportation infrastructure, intelligent collaborative operation technology for urban transportation infrastructure, autonomous driving technology, high-speed bearing technology, whole-vehicle production technology, power battery technology, electric motor technology, electronic control system tech-

nology, vehicle-grade chip technology, and safety warning technology.

Group 3 Key and hot topics concerning knowledge production and public understanding of science

◎Frontiers of mathematics

Key areas of focus include control theory and stochastic complex systems, mathematical mechanization and its applications, big data analysis, numerical algorithms for high-dimensional partial differential equations based on deep learning, medical image analysis algorithms based on deep convolutional neural networks, infectious disease dynamics models, new theories, new methods, new technologies, and new applications in mathematics, and algorithm design.

◎Frontiers of physics

Key areas of focus include quantum information, time crystal simulation, inertial fusion, particle cooling, condensed matter physics, and black hole magnetism.

◎ Frontiers of chemistry

Key areas of focus include precise control of stereodynamics, new synthesis strategies, concepts, and techniques, analytical chemistry under extreme conditions, molecular design and controllable preparation of function-oriented materials, green and sustainable innovative chemical technologies, and sustainable paradigms in chemical manufacturing.

◎ Frontiers of life sciences

Key areas of focus include personalized medicine, carbohydrate synthesis and recognition, artificial intelligence and machine learning in structural biology, drug design, and systems biology.

◎ Frontiers of Earth science

Key areas of focus include applications of big data in geodynamics, deep processes and habitability of the Earth, Earth system science, deep structure and dynamics of the Earth, surface processes and environmental

change, evolution of Earth's life and biogeochemistry, Earth's resources and energy, and Earth's disasters and risks.

◎Frontiers of astronomy and astrophysics

Key areas of focus include the formation and evolution of black holes, the impact of spacecraft collisions on planetary orbits, the equivalence of inertial mass and gravitational mass, and the potential habitability of extraterrestrial planets.

◎Heritage and technological civilization

Key areas of focus include technological civilization, scientific culture, the history of technology, protection of cultural heritage, digital archaeology, technological archaeology, establishing digital museums, and utilization of advanced technology for the preservation of cultural relics.

◎ Promoting science literacy and popularizing science

Key areas of focus include fostering public scientific literacy, advancing science education, promoting the popularization of science, enhancing science communication, facilitating the informatization of popular science, establishing science museums, and developing infrastructure for popular science.

◎ Frontiers of engineering

Key areas of focus include full-lifecycle digital twin technology, human-machine symbiotic robot development, integration of optical and electrical circuits, AI empowered integrated systems, intelligent perception and safety control of autonomous unmanned systems.

Group 4 Key and hot topics in global technology governance

◎Ethical governance of emerging technologies

Key areas of focus include data management and privacy protection, regulatory technology and governance of artificial intelligence, principles and norms of digital ethics, emerging issues and challenges in the governance of emerg-

ing technologies, and balancing technological benefits and risks.

◎ Machine learning and human values

Key areas of focus include reliable and explainable artificial intelligence technologies and solutions, algorithmic bias, evaluation of privacy consequences in algorithmic systems, human-machine emotional interaction, alignment challenges, personal data, and safeguarding consumer interests.

◎ Integration and development of technology and cultural industries

Key areas of focus include classification and identification of cultural resources, digitization and management, knowledge-based processing of multimedia content, augmented reality (AR)/virtual reality (VR) production, and intelligent design.

◎Open science

Key areas of focus include fostering open access to scientific knowledge, enhancing open science infrastructure, and promoting active involvement from societal players.

◎Faith in science

Key areas of focus include developing an ethos for scientists, upholding scientific credibility, leveraging technology for social good, and endorsing responsible research practices.

◎Research integrity

Key areas of focus include managing norms related to research integrity, reforming research evaluation and incentive systems, promoting scientific ethics, developing policies and institutions dedicated to research integrity, and guiding research conduct in international collaboration.

◎Technology law

Key areas of focus include green and low-carbon technology and law, biosafety and law, artificial intelligence and law, cyberspace activities and law, data governance and law, research on technology and law compliance, legal issues related to emerging technologies, legal issues associated with technological globalization, and jurisdictional and legal applicability in international technological cooperation.

◎Technology economics and innovation management

Key areas of focus include assessment of emerging technologies, economic evaluation of technologies, innovation and entrepreneurship, pro-technology finance, information and communications technology and economics, science and technology innovation policies and evaluation, technology incubation and innovation ecosystems, environmental technology and economics, and energy innovation and environmental regulation.

◎ Engineering education and international mutual recognition

Key areas of focus include training outstanding engineers, challenges in developing engineering talent, engineering mobility and international mutual recognition, international engineering education standards and professional competency standards, and engineering ethics.

(Source: *2023 International Science and Technology Conference Agenda Guidelines*)

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