INFINITE POTENTIAL

The 2019 TENCENT WE SUMMIT was based on the theme 'Infinity Within' signalling its bold ambition and scope. Participants examined scientific wonders in diverse realms, from the mysteries of the human body, to the edge of the galaxy and beyond.

What has been long considered everything in the universe may actually be only a small part of a much wider cosmic landscape, according to Brian Greene from Columbia University, who explored the concept of 'multiverse' at the 2019 WE Summit, held in Beijing this November. Organized by Tencent, in partnership with Nature Research, the summit attracted thousands of delegates, as well as 20 million online viewers. It featured nine multidisciplinary presentations, addressing some innovative and progressive blueprints for our future, and theories about our origin.

Fundamental studies on nature's extremes

Greene used three interwoven stories to explain the discovery and evidence for our existence in the multiverse: gravity, string theory and the Universe's accelerating expansion. "In the macro world, we have Einstein's theory of general relativity, giving rise to the mathematical theory of the Big Bang and suggesting possibilities of other universes," said Greene. Given the leftover fuel from explosions following the Big Bang, new universes may be created, he explained. But a fuller picture can only come to light with string theory to unite quantum mechanics and gravity.

"We have strings, or hypothetical vibrating filaments. The complication is that string theory only works if there are more than three dimensions of space." Greene showed how the manifold shapes of the extra dimensions in the micro world are able to answer many questions, such as the mass of quarks.

He also explained that there were five known shapes for extra dimensions in the 1980s, which have grown to almost tens of thousands of possibilities today, adding to the evidences supporting the theory of multiverse.

Back to the mysteries beneath the Earth's crust, Jennifer Jackson, from Caltech, discussed what made up the 'multi-scale structures', or continent-sized 'blobs' sitting at the base of the mantle. Combing mineral physics with geophysical observations and geodynamic modelling, her team has been visualizing the Earth's inner core with the latest available equipment, such as seismic tomography technologies.

Ultra-dense seismic network and extra-terrestrial missions to image the interiors of other planets with even higher resolution, along with other observations, will bring to light the fundamental nature of these blobs, and their connection to plate tectonics, volcanism and exoplanet habitability, said Jackson.

Focusing on neutrinos, fundamental particles that make up the Universe, Yifang Wang from the Institute of High Energy Physics, Chinese Academy of Sciences, led a project that made the first observation of the third type of neutrino oscillation in 2012, unlocking mysteries behind the matter-antimatter asymmetry in the Universe. For Wang, technological capability has been the most important factor for success.

Wang singled out photomultipliers (PMTs) as the essential device in his neutrino experiment, as they enable the detection of individual photons. "We previously relied on PMTs from a Japanese supplier," said Wang. "To save cost and improve efficiency, we have developed PMTs ourselves." Now a whole production line has been established, and PMTs are exported. This is illustrative of how basic science research drives technological progresses, which in turn, enable major scientific discoveries.


Brian Greene


Carl June


Hod Lipson


Jennifer Jackson


Magdalena Skipper


Thomas Baden


Luping Shi


Yifang Wang


David Wallerstein

Think big for a bold future

Science and technology are well integrated in fields like robotics and artificial intelligence. For roboticist, Hod Lipson, from Columbia University's Creative Machines Lab, improving on physical and mental robustness are priorities for engineers to enhance intelligent machines. "It is time to give machines the same abilities that evolution has given us: self-awareness and self-repair," said Lipson, who believes that the benefits of intelligent technology will outweigh the risks.

Lipson defined self-awareness as the ability to simulate and see oneself in the future. This means the robots need to first form a self-image, which facilitate their learning how to walk. Such self-simulation saves costs and risks in the physical world, especially when systems become more complex.

Instead of monolithic robots, which will break down when one part fails, Lipson's team has also developed particle robots, which are to be built from an increasing number of miniaturised units, programmed to heal, and grow themselves. His next goal is for robots to model other robots, initiating social interactions both between machines and beyond human-machine interfaces.

"We are living in the best of times empowered by artificial general intelligence (AGI) and its many associated innovations," agreed Tsinghua University's Luping Shi, whose team spearheaded the world's first hybrid-paradigm brain-inspired chip. Using just one chip, which enabled simultaneous processing of complex algorithms and models, Shi's team demonstrated real-time object detection, tracking, voice control, obstacle avoidance, and balance control in an unmanned bicycle course. Yet, no matter how advanced machine learning or AGI has become, it comes down to human development.

"I sincerely believe that we can begin with ourselves from within to holistically engineer a better world for social good," said Shi. His idea echoes the corporate culture mission and vision launched in November by Tencent, 'Value for Users, Tech for Good'.

The societal value brought by science is well demonstrated by the benefits of immunology research for cancer patients, as outlined by Carl H. June from the University of Pennsylvania.

Trained as a bone marrow transplant specialist, June described how it was almost chance that he became involved in the first trials in patients with HIV/AIDS of Chimeric Antigen Receptor T (CAR-T) cells — genetically engineered T cells of the immune system which can divide and stay in the body for years.

Having seen 90% cancer remission in clinical trials, June's team obtained FDA approval in August 2017. The therapy has already treated many children with blood cancer, and for June, this is the best reward. His challenge now lies in popularizing this expensive therapy, and accelerating the approval process with more clinical trials for other forms of cancer.

For Magdalena Skipper, Editor-in-Chief of Nature, "genetics has become far more complex and far less deterministic than we've imagined."

In outlining the scope of genetics studies, especially with the development of epigenetics, she summarized, "nothing in evolution makes sense except in the light of genetics, and nothing in genetics makes sense except in the light of environment."

Studying the neural mechanisms underlying visual systems, Tom Baden from the University of Sussex recognized the importance of the right tools in driving research, and was determined to make these tools accessible to more researchers, especially those in financially disadvantaged regions.

For his efforts promoting open labware and data sharing, along with his neuroscience contributions, Baden was selected as the winner of the inaugural Nature Research Award for Driving Global Impact, sponsored by Tencent.

Dedicated to addressing the global challenges over the years, Tencent's Chief eXploration Officer David Wallerstein mused on the world of possibilities offered by electric aircraft capable of vertical take-off and landing. "This is expected to bring fundamental changes to our transportation infrastructure," he observed. ■

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