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CONFERENCE REPORT

Tencent WE Summit 2018

Pushing horizons by exploring a universe of unknowns

In the Hollywood blockbuster, *Interstellar*, a spaceship travels across the universe in minutes to a black hole 10 billion light-years from Earth. Such Hollywood imaginings may not be as far-fetched as they seem, said Kip Thorne, the 2017 Nobel laureate in physics, addressing the 2018 Tencent WE Summit in Beijing. "If we consider the universe as warped, the distance from our solar system to say, the Andromeda galaxy, can be shortened by travelling back and forth through wormholes."

From interstellar travel, black holes and dark matter, to lab-made life, brain networks and health informatics, the 2018 Tencent WE Summit, organized in partnership with Nature Research, drew scientists from a range of disciplines to explore mysteries 'hidden in time', the theme of this year's summit. The presentations showcased how science and technology bring understanding of the universe and life, lighting up the future.

Exploring mysteries in the universe

Einstein's theory of general relativity allows for wormholes, a tunnel-like structure linking two points in space-time, and possible shortcuts for journeys across the universe or time. However, they do not occur naturally and may experience sudden collapse, said Thorne.

Unlike wormholes, black holes are already proven. Gravitational pull is stronger closer to a black hole, where time passes more slowly. In the centre of black hole, time may even run backwards, making reverse time travel possible.

Thorne also discussed gravitational waves, which are basically ripples in space caused by acceleration of masses. Unlike electromagnetic waves, they are not easily absorbed or scattered. In 2015, he led the LIGO team to detect gravitational waves, which possibly occur through the merging of two black holes, for the first time. "We might also see the collision of neutron stars, or even the birth of the universe through gravitational waves," said Thorne. Insights on gravitational and electromagnetic waves will lead to greater discoveries.

Space telescopes are another tool to probe deeply into the universe. The renowned Hubble Space Telescope, launched in 1990, has yielded a treasure trove of data about the universe, said Mark McCaughrean from the European Space Agency (ESA). The James Webb Space Telescope (JWST), a collaboration between NASA, ESA and the Canadian Space Agency, is to succeed Hubble to become the premier space-based observatory.

With a 6.5-metre primary mirror made of 18 segments, JWST is much more powerful than Hubble, and half its weight. Too big to be launched in an operational state, it will be folded and then opened in space. An infrared telescope, it will allow scientists to view faint and distant stars and galaxies, exploring regions in the universe with no visible light. "It will enable us to see the formation of young stars and galaxies," said McCaughrean. "We can even study planets outside the solar system to see if any have atmosphere suitable for life."

In the formation of the solar system, dark matter may be crucial, according to Lisa Randall, a theoretical physicist from Harvard University. "Dark matter and dark energy make up the majority of the universe," said Randall. "Only 5% is made up of the atoms we know and that's the world we see." Like regular matter, dark matter interacts via gravity, but not with baryonic matter. As it does not interact with light, it is invisible, detectable only by its gravitational influence, said Randall.

Randall also hypothesized that a dark disc may exist in the Milky Way galaxy that affects the solar system. As the sun passes through the dark matter, the resulting gravitational disturbances may trigger periodic comet strikes. "One of the strikes might have caused the K-Pg extinction in which dinosaurs became extinct," said Randall. "But that also made way for the emergence of large mammals, including us."

Exploring mysteries about life and health

The brain is like our internal universe. How does the brain function and understand the external world? Mu-ming Poo from the Institute of Neuroscience, Chinese Academy of Sciences (CAS) introduced his vision of the China Brain Project. "Its objectives can be summarized into one body and two wings," said Poo. The main body is the basic research to understand the neural basis of cognitive functions. This requires platforms to study cognitive development, including mapping the mesoscopic connectome. The two wings are the extended technologies that address societal needs. These include developing approaches in early diagnosis and intervention of brain disorders, and contributing to brain-machine intelligence technologies.

The world-first cloning of monkeys by Poo's team members will advance the brain project. "We have models to study monkey's brain connectome now," said Poo. "Using gene editing tools, we can also build monkey models for pre-clinical studies of brain disease therapeutics."

Gene editing tools have also enabled creating new life-forms. Zhongjun Qin from CAS's Shanghai Institute of Plant Physiology and Ecology described his scientific quest. He found that most eukaryotes, ranging from plants to animals, have linearly arranged chromosomes, but their number seems random, with no correlation to the amount of genetic information they carry. Qin wanted to create a eukaryote with one chromosome carrying all the genetic information, and using CRISPR-Cas9, his group fused the 16 chromosomes of brewer's yeast into one. "We found this human-designed species with one giant chromosome grows nicely, almost the same as natural yeast in cell growth and gene expression," said Qin.

Qin said his research could lead to a method to make a super nutritious yeast, and provides models to study the functions of telomeres, linked to ageing and cancer.

Joel Dudley, from the Icahn School of Medicine at Mount Sinai, studied brain tissues to look for genes that might be linked to Alzheimer's disease. Complex data analysis by his team has led to the discovery of gene networks linking specific viruses, including herpes, with Alzheimer's pathology, suggesting novel targets for new drugs and strategies to prevent the disease.

"With today's technologies, we can sequence more, enabling data-driven tools to redefine diseases in a holistic approach," said Dudley, who aims to use the big data approach to connect precision medicine to precision wellness.

Tencent is also developing AI technology for healthcare, according to David Wallerstein, the company's Chief eXploration Officer. "From regular health check-ups to early tumour detection, there is much more we can do with AI for saving lives in the future," he said. Wallerstein also called for policy-makers, entrepreneurs, and scientists to address the challenges of food, water and energy shortages.

Addressing the world's grand challenges is also on the agenda of Springer Nature. Philip Campbell, its editor-in-chief, discussed the importance of transformative research. "We want to award impact-making research to amplify the benefits that research can bring to society." To this end, in partnership with Tencent, the Nature Research Award for Driving Global Impact celebrates early-career researchers committed to research that makes a positive impact on society. ■

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