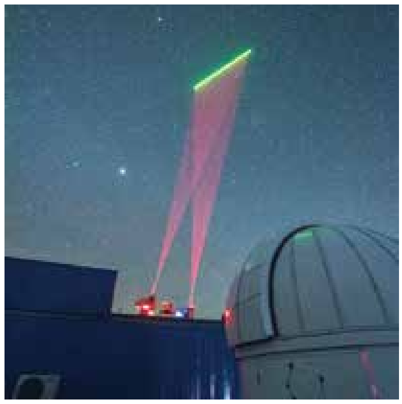
In This Issue

HIGHLIGHTS|PHYSICS

Micius disproves "event formalism" model

In their nine-decade-long endeavor to bridge quantum mechanics and general relativity, physicists have proposed many models of quantum gravity, the "ultimate theory" of the cosmos. Most of them, however, demand extremely stern experimental conditions to test. The "event formalism" model is an exception that offers some basis for experiments, though it still asks for a challenging accuracy that has frustrated many physicists.



(Image by USTC)

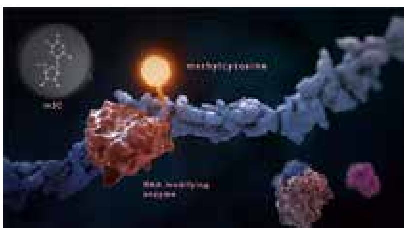
According to this model, the entangled quantum pairs could decorrelate at some possibility when undergoing the fluctuation of the Earth's gravity. *Micius*, a satellite developed by CAS for quantum physics experiments flying at an altitude of about 500 km above the Earth, provides an ideal platform to test this hypothesis.

With an ultra-high precision, *Micius* distributed entangled quantum pairs across the space surrounding the Earth, and allow them to intercept different regions of the Earth's gravitational field. At last, the experiment verified that all the entangled quantum pairs survived the effect of the Earth's gravity in consistence with the standard quantum theory, and disapproved the prediction by the "event formalism" model.

Read more on page 137.

HIGHLIGHTS|EPIGENETICS

Tiny yet mighty



(Image credit: STORM Therapeutics, UK)

An RNA modifying enzyme adds a methyl group (lighted up in pink in the image) to a cytosine within a strand of mRNA to give rise to a methylcytosine (m5C). Such a change may cue the cell to another fate that is different from the one when the m5C is just a normal C. Recently, CAS scientists discovered that certain chemical marks on mRNA, acting as a hidden layer of gene regulation, are able to promote tumor growth and invasiveness. The study of various chemical widgets added to RNA, up to more than 100 different forms, has not only ushered into a new booming field dubbed *RNA epigenetics*, but also hatched a couple of start-ups in pursuit of new anti-cancer drugs by targeting the enzymes that write, read or erase these tiny marks. Read more on page 140.

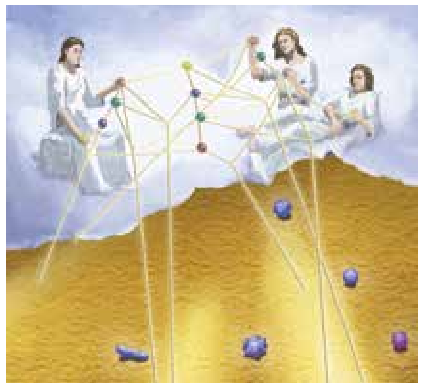
HIGHLIGHTS|DEVELOPMENTAL BIOLOGY

"Fate teller" of cell lineages

The stem cells in a mammalian embryo know their fate very early – only days after fertilization, they will be assigned different locations on a three-layer structure called "gastrula", and the allocation will define their future destination. They are set to develop into some certain organs, depending on which "room" they live in this tiny three-story building, and no other – they will lose the potential or ability to develop into any other type of organs than the one allowed by their "fate".

Only days ago, in a two-layer sprout called "blastula", their progenitor cells were still "totipotent", which means they could grow into any an organ of the future animal. What has happened when the two-story building expanded into a three-story architecture?

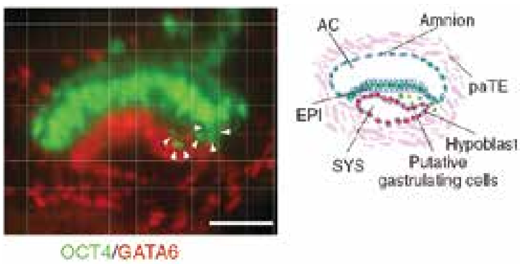
Now a molecular "chart" of the whole process of this "expansion", combining spatial and temporal dynamics, will tell the story with great detail. For more, please turn to page 145.



(Image by SIBCB)

HIGHLIGHTS|DEVELOPMENTAL BIOLOGY

Monkey embryos grown in dishes

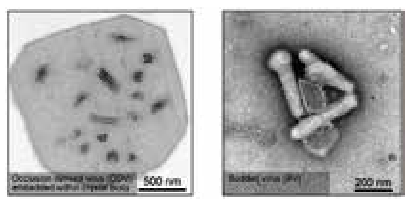


(Image credit: *Science*)

"It is not birth, marriage, or death, but gastrulation, which is truly the most important time in your life," said Lewis Wolpert in1986, an eminent developmental biologist. Because during gastrulation, cell migrations lead to a massive reorganization of the embryo from a simple spherical ball of cells, the blastula, into a multi-layered organism. A dearth of primate embryo samples at the gastrulation stage has, however, limited our understanding of this critical event in primates. Now, CAS scientists developed an *in vitro* culture (IVC) system that supports the growth and development of cynomolgus monkey embryos for up to 20 days after fertilization and beyond gastrulation. Instead of growing embryos in surrogate wombs, they cultured these primate embryo samples in petri dishes, which might open a new window on human embryonic development. Read more on page 150.

HIGHLIGHTS|VIROLOGY

What stops baculoviruses efficiently getting into mammalian cells



(Image by WHIOV)

Baculoviruses are large, rod-shape DNA viruses that specifically infect insects, mainly the larvae of butterflies and moths. After millions of years of co-evolution with their insect hosts, baculoviruses have developed unique replication cycles featuring with two distinct virus forms: occlusion-derived virus (ODV) and budded virus (BV). The ODVs mediate the viral spread among different larvae and the BVs spread infection within larval body via cell-to-cell transmission.

Apart from infecting insect larvae, they can also pass on genes into mammalian cells (including human cells) by transduction, a process of viral entry into the host without producing progeny viruses. For that, they are promising vectors for human gene therapy. There is, however, an unsolved obstacle that the mammalian transduction is very inefficient. To address that, scientists from the CAS Wuhan Institute of Virology (WHIOV) sought to figure out the major roadblock to mammalian cell entry of baculovirus and find out a solution to overcome it. More detail is revealed on page 153.

INDEPTH|COSMOLOGY

Cosmos through lens of LHAASO

(Image by IHEP)

On the Haizi Mountain of Daocheng city, Sichuan province of China, the first detectors in the array of the Large High Air Altitude Shower Observatory (LHAASO), a major national science facility jointly built by CAS and the Sichuan Provincial Government, initiated their first observations in April 2019. Kicked off in June 2017, the whole construction is to be completed by 2021; the following years will see more and more detectors of it come into operation.

By capturing particles in the Earth's atmosphere derived from cosmic rays, this big array might help scientists understand some basic astrophysical issues, including where have the cosmic rays come from, how dark matter is possibly distributed, and how celestial bodies evolve. Moreover, it can even offer some new hope on solving the "ultimate question" in physics of our era: are space and time continuous or discrete? Can we really bridge the two giant theories of modern physics, quantum mechanics and general relativity?

BCAS has invited a group of scientists working in related fields to envision what LHAASO can help them to do. For more, please turn to page 157.