DAVID SWANSON/REUTERS

Climate change could exacerbate droughts, such as the one that dried up this lake in California.

THE SCIENCE EVENTS TO WATCH FOR IN 2022

Omicron, Moon missions and particle physics are among the themes set to shape research in the coming year.

By Davide Castelvecchi

COVID continues

As the world enters the third year of the COVID-19 pandemic, with no end in sight, an immediate challenge is to better understand the impact of and threat posed by Omicron — the fast-spreading coronavirus variant first spotted at the end of November. Early results indicate that vaccines are less effective against Omicron; scientists are still racing to find out more about the severity of the disease it causes.

In 2022, researchers and public-health authorities will also continue to monitor the long-term effects on people who have recovered from COVID-19.

Wealthy countries have begun giving their populations booster shots of existing vaccines, and these roll-outs are likely to continue amid concerns about Omicron. But nearly half the world's population has not yet received a single dose of a vaccine. One big question is whether pharmaceutical companies will waive patents or take other steps to help make their vaccines more affordable for lower-income countries. Meanwhile, discussions about the origins of the virus are set to continue. The World Health Organization has appointed a team of 26 scientists to investigate.

Vaccines upgraded

Vaccine developers have set their sights on the next generation of compounds to protect against the rapidly evolving coronavirus. This year could see the development of messenger RNA vaccines that are targeted to specific variants, and some public-health officials are hoping for an increased role for vaccines using other technologies. Protein-based vaccines are a more conventional kind of immunization — some have been used for decades against diseases including hepatitis and shingles — and in 2021, they showed promise in phase III COVID-19 clinical trials. Vaccines based on DNA are cheaper to manufacture than mRNA vaccines and do not require cold storage, so could be good alternative for lower-income countries.

Progress is also expected on vaccines for other major viruses and diseases, including HIV, malaria and Lyme disease.

Big physics bonanza

After a multi-year shutdown and extensive maintenance work, the Large Hadron Collider (LHC) is scheduled to restart operations at CERN, the European particle-physics laboratory outside Geneva, Switzerland, in June. The LHC's major experiments ATLAS and CMS have been upgraded and expanded with extra layers of detector components. This will enable them to collect more data from the 40 million collisions of protons each of them produces every second.

And after their own upgrades, the world's four gravitational-wave detectors — one in Japan, one in Italy and two in the United States — will begin a new observing run in December.

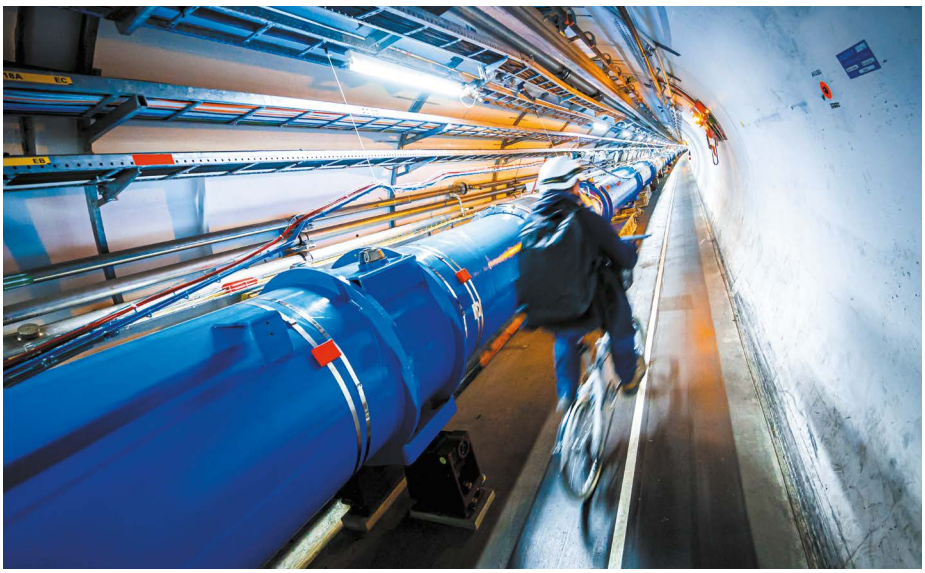
At Michigan State University in East Lansing, the Facility for Rare Isotope Beams is expected to start operations in early 2022. The US$730-million multi-stage accelerator aims to synthesize thousands of new isotopes of known elements, and it will investigate nuclear structure and the physics of neutron stars and supernova explosions.

Moon missions

A veritable armada of orbiters and landers from space agencies and private companies is scheduled to leave for the Moon in 2022. NASA will launch the Artemis I orbiter in the first test of the long-overdue launch system that is intended eventually to take astronauts back to the surface of the Moon. And the agency's CAPSTONE orbiter will conduct experiments in preparation for the Gateway, the first space station to orbit the Moon.

India's third lunar mission, Chandrayaan-3, aims to be its first to make a soft landing (one that doesn't damage the craft) and will include its own rover. Japan will also attempt its first soft landing on the Moon, with the SLIM mission, and Russia is aiming to revive the glory of the Soviet lunar programme with the Luna 25 lander. The Korea Pathfinder Lunar Orbiter will inaugurate South Korea's Moon exploration.

On the private side, Tokyo-based company ispace is launching the Hakuto-R lander, which will carry the United Arab Emirates' Rashid Moon rover. Two US companies, Astrobotic Technology in Pittsburgh, Pennsylvania, and Intuitive Machines in Houston, Texas, are readying probes that will carry NASA instruments to the lunar surface.



VALENTIN FLAURAUD/AFP/GETTY

The beamline of the Large Hadron Collider, which will restart operations in 2022.

"A veritable armada of orbiters and landers is scheduled to leave for the Moon in 2022."

To Mars and the stars

Another epic space journey to watch will be the joint Russian–European ExoMars mission, which is scheduled to blast off in September. It will carry the European Space Agency's Rosalind Franklin rover to Mars, where it will search for signs of past life. The launch was originally scheduled for 2020, but has been delayed, partly because of issues with the parachutes needed to touch down safely.

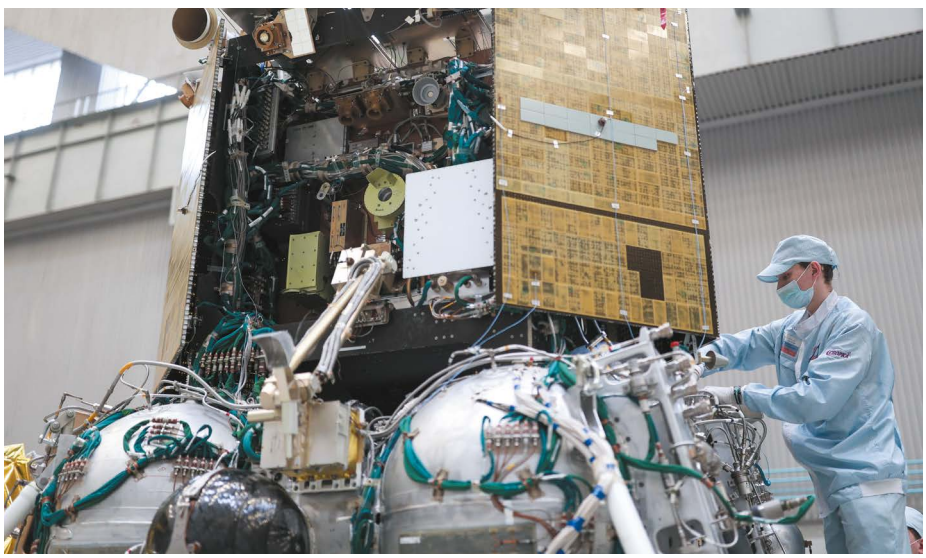
China also plans to complete its space station, Tiangong, and has lined up more than 1,000 experiments for it, ranging from astronomical and Earth observation to the effects of microgravity and cosmic radiation on bacteria.

Climate action

Energized by last year's 26th United Nations Climate Change Conference of the Parties (COP26) in Glasgow, UK, delegates from around the world will converge on Sharm El-Sheikh, Egypt, in November for COP27. Countries are expected to come up with commitments consistent with the 2015 Paris agreement goal of keeping global warming to well below 2°C. Researchers will be monitoring greenhouse-gas emissions following pledges made at COP26 — which included promises to reduce the use of coal and cut methane emissions.

Push to save biodiversity

Countries are working on a new set of targets to slow down the loss of biodiversity. The Aichi Biodiversity Targets, established in 2010, mostly missed their 2020 deadline. The next meeting of parties to the UN Convention on Biological Diversity — originally planned for 2020 — is scheduled to take place in Kunming, China, from 25 April to 8 May. Habitat loss and other factors have put an estimated one million plant and animal species at risk of extinction.



SERGEI BOBYLEV/TASS/GETTY

Russia's Luna 25 lander will begin its journey to the Moon next year.