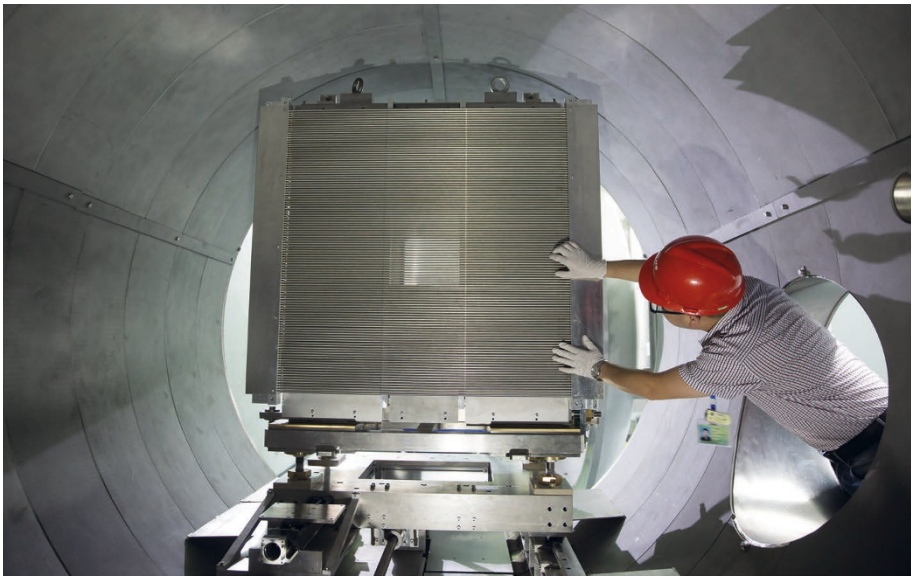

JIN LIWANG/XINHUA VIA ZUMAPRESS

Engineers work on an instrument at the China Spallation Neutron Source in Dongguan.

PHYSICS

China fires up neutron facility

Beam generator puts country in elite company for doing experiments in materials science and other fields.

BY DAVID CYRANOSKI

China is revving up its next-generation neutron generator and will soon start experiments there. That will lift the country into a select group of nations with facilities that produce intense neutron beams for studying the structure of materials.

The China Spallation Neutron Source (CSNS) in Dongguan, a 2.2-billion-yuan (US$331-million) centre, will enable the country's growing pool of top-notch physicists and material scientists to compete in multiple fields, along with their international collaborators. The neutron source's designers also hope that it will lead to commercial products and applications ranging from batteries to cancer therapies.

"It is not only a big step forward for Chinese scientists, but also a significant event for the international scientist community," says Wang Xun-Li, a physicist at the City University of Hong Kong who has been involved in planning the facility.

Spallation neutron sources produce neutrons by slamming protons onto a metal target — the CSNS uses tungsten. They are more cost effective and safer than other methods, which use nuclear reactors to produce neutron beams. Because neutrons have no charge, they can penetrate materials more easily than some other probing techniques, and they are more sensitive to light elements such as hydrogen, which makes them useful for evaluating candidate materials for fuel cells. Similar facilities currently exist only in the United Kingdom, United States, Japan and Switzerland. Another is under construction in Sweden.

Fujio Maekawa, a specialist in neutron sources at the Japan Proton Accelerator Research Complex in Tokaimura, says that although the CSNS delivers neutrons at a lower density than other spallation sources, a planned upgrade will bring it in line with other facilities. And, given the facilities' scarcity, "neutron users around the world always welcome new sources", he says.

The CSNS will have capacity to host 20 beam lines, supplying as many instruments. Preliminary tests of its first three instruments began on 1 November. "Neutrons arrived at the samples as expected," says Wang Fangwei, head of the neutron-science division at the CSNS. He expects the instruments to be calibrated and ready for initial experiments by January.

Chinese physicists are eager to use the facility to analyse the underlying magnetic properties of materials — an area of strength for China. Wang Xun-Li says that several planned instruments will give scientists the chance to move to the forefront of fields such as the physics of skyrmions — vortex-like excitations in magnetic materials — and high-temperature superconductivity. "There are a whole bunch of early- to mid-career scientists who are hungry to use the facility for studying magnetism," he says.

Wang Xun-Li thinks that the new facility will encourage Chinese researchers to stay in their home country. "In the past, it was common to see Chinese scientists go abroad for these kinds of studies," he says.

The facility's first instruments are also attracting international researchers. Material scientist Frank Klose says that the CSNS was a major factor when he and material scientist Christine Rehm, his wife, decided to join the new Guangdong Technion Israel Institute of Technology in Shantou, 400 kilometres east of Dongguan. Klose's research focuses on designing data-storage devices and sensors that could be used in hydrogen-powered cars. He helped to design one of the facility's instruments to investigate the magnetic properties of spintronic devices, which use the spin of electrons to store data.

But some scientists contacted by *Nature* have raised concerns about the CSNS's location, saying that Dongguan lacks services and infrastructure, such as schools and universities, that would lure top scientists and their families to move there. "I believe CSNS is suffering from a lack of first-grade scientists who actually are based in Dongguan," says a researcher familiar with the facility, who asked for anonymity because of the sensitivity of the issue. Potential users have also expressed some frustration that only 3 instruments will be ready this year, despite the facility's capacity to host 20.

But more instruments are already being built. The government of Shenzhen, a city near Dongguan, is funding two that are expected to be ready by the end of 2019 — including one designed to model high-pressure environments, such as Earth's core. Mao Ho-Kwang, a geophysicist at the Carnegie Institution for Science in Washington DC, is keen to use it to simulate what happens to materials in high-pressure conditions. "The CSNS instruments will be a great asset," says Mao. "I am very excited, and the whole neutron community is getting very excited, too". ■

CORRECTION

The News Story 'Engineered apple tests US consumers' appetite' (*Nature* **551,** 149–150; 2017) erroneously stated that Neal Carter took over his family's orchard. In fact, he simply bought an orchard. Also, Finless Foods is located in Berkeley, California, not New York City.