properties: its sheets are stronger than steel and conduct electricity better than copper. It has shown superconductivity before[3], but that occurred in contact with other materials, and the behaviour could be explained by conventional superconductivity.

Physicist Pablo Jarillo-Herrero at the Massachusetts Institute of Technology (MIT) in Cambridge and his team weren't looking for superconductivity when they set up their experiment. Instead, they were exploring how the orientation dubbed the magic angle might affect graphene. Theorists have predicted that offsetting the atoms between layers of 2D materials at this particular angle might induce the electrons that zip through the sheets to interact in interesting ways — although they didn't know exactly how.

The team immediately saw unexpected behaviour in its set-up. First, measurements suggested that the construction had become a Mott insulator[2]. These materials have all the ingredients to conduct electrons, but interactions between the particles stop them from flowing. Next, the researchers applied an electric field to feed a few extra charge carriers into the system, and it became a superconductor[1]. The existence of an insulating state so close to superconductivity is a hallmark of cuprates and other unconventional superconductors.

"These new experiments give cause for cautious celebration."

Although graphene shows superconductivity at a very low temperature, it does so with just one-ten-thousandth of the electron density of conventional superconductors that gain the ability at the same temperature. In conventional superconductors, the phenomenon is thought to arise when vibrations allow electrons to form pairs, which stabilizes their path and allows them to flow without resistance. But with so few available electrons in graphene, the fact that they can pair up suggests that the interaction at play in this system is much stronger than what happens in conventional superconductors.

Graphene-based devices will be easier to study than cuprates, which makes them useful platforms for exploring superconductivity, says Bascones. For example, 'tuning' cuprates to explore their different behaviours means growing and studying reams of different samples; with graphene, physicists can achieve the same results by simply tweaking an electric field.

Physicists cannot yet state with certainty that the superconducting mechanism in the two materials is the same. And Laughlin adds that it is not yet clear that all the behaviour seen in cuprates is happening in graphene. "But enough of the behaviours are present in these new experiments to give cause for cautious celebration," he says. ■

1. Cao, Y. *et al. Nature* http://dx.doi.org/10.1038/nature26160 (2018).
2. Cao, Y. *et al. Nature* http://dx.doi.org/10.1038/nature26154 (2018).
3. Ichinokura, S., Sugawara, K., Takayama, A., Takahashi, T. & Hasegawa, S. *ACS Nano* **10,** 2761–2765 (2016).

POLLUTION

China tests giant air cleaner to combat urban smog

Prototype produces clean air and offers an innovative solution to a public-health hazard.

BY DAVID CYRANOSKI

A 60-metre-high chimney stands in a sea of high-rise buildings in one of China's most polluted cities. But instead of adding to Xian's smog, this chimney is helping to clear the air. The outdoor air-purifying system, powered by the Sun, filters out noxious particles and billows clean air into the skies. Chinese scientists who designed the prototype say that the system could significantly cut pollution in urban areas in China and elsewhere.

The technology has intrigued researchers — especially in China, where air pollution is a daily challenge. Early results, yet to be published, are promising, says the project's leader, Cao Junji, a chemist at the Chinese Academy of Sciences' Key Laboratory of Aerosol Chemistry and Physics in Xian in central China.

"This is certainly a very interesting idea," says Donald Wuebbles, an atmospheric scientist at the University of Illinois at Urbana-Champaign, who has heard about the system but not seen it in action. "I am not aware of anyone else doing a project like this one."

The prototype, built with US$2 million in funding from the provincial government, has also caught the attention of the president of the Chinese Academy of Sciences, Bai Chunli, who visited the site last month. Cao says Chinese leaders are eager for solutions to air pollution because it creates such a widespread public-health problem. The Global Burden of Disease Study for 2015, a comprehensive effort to map the world's diseases, found that pollution contributed to 1.1 million premature deaths in China in that year alone.

Cao has submitted a proposal for another tower in Xian, this one 300 metres tall. He is also negotiating proposals with cities in Guangzhou, Hebei and Henan. But the technology has its sceptics, who say that there are much cheaper ways to reduce air pollution.

The concrete chimney sits on top of a

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STEVE LOWRY

Inside a chimney that releases filtered air, part of a pilot project to reduce smog in Xian, China.

DAVID CYRANOSKI/*NATURE*

large open structure with a glass roof. Solar radiation hitting the glass heats the air, causing it to rise into the tower. The air then passes through a wall of industrial filters before billowing out of the chimney.

"This is a very well-designed and well-made prototype," says Renaud de Richter, a chemical engineer at the Higher National Institute of Chemistry in Montpellier, France, who has worked on solar-energy towers similar to those that inspired Cao's system. Richter says that Cao's success could help to convince investors to support other applications based on the flow of solar-powered air through chimneys.

Pollution peaks during winter in China, and Cao conducted his first test of the system's air filters over two weeks in January. At the tower, and at 10 monitoring stations across a 10-square-kilometre area, he placed monitors that measured particulate matter less than 2.5 micrometres in diameter (PM2.5), a type of pollution that has plagued Chinese cities.

He found that the tower expels between 5 million and 8 million cubic metres of filtered air a day in winter. During the study period, the surrounding air monitors registered a 19% decrease in PM2.5 concentrations compared with monitors in other parts of the city. Cao is preparing the results for publication.

The project leader says that the prototype's impact was local, so he proposes creating arrays of about half a dozen larger chimneys distributed around urban centres. "We need multiple systems so that significant reduction of air-pollution concentration can be achieved," he says.

Neil Donahue, who studies atmospheric particles at Carnegie Mellon University in Pittsburgh, Pennsylvania, says there is little doubt that pulling a large volume of air through high-efficiency particulate filters will clean it. But he wonders if the benefits will be worth the environmental damage caused by building and running such facilities. Turning the same amount of power into clean electricity, or not emitting the pollution in the first place, might achieve the same pollution cuts, he says.

"This is certainly a very interesting idea. I am not aware of anyone else doing a project like this one."

Wuebbles also worries that the chimney wouldn't filter precursors to particulate matter, such as sulfur dioxide gas and nitrogen oxides, or secondary gaseous pollutants such as ozone. "While the sky may look cleaner, the air quality can still be really awful," he says.

Cao says that the system already removes nitrogen oxides, one of the major precursors of ultra-fine particles and ozone. He also says that concerns about the economics are overblown. He says the pilot project costs about $30,000 a year to run. Despite some reservations, researchers including atmospheric scientist Jose-Luis Jimenez, at the University of Colorado Boulder, see an advantage in pursuing the technology. "I'd definitely say it is worth exploring it more, though I am not convinced either way at this point," Jimenez says. ■

FUNDING

Science wins in Canada budget

Government focuses its spending on basic research.

BY BRIAN OWENS

Canadian Prime Minister Justin Trudeau's administration released its 2018 budget on 27 February and scientists couldn't be happier. It includes nearly Can$4 billion (US$3.1 billion) in new funding for science over the next five years, a significant portion of which will go to the country's three granting councils. This is in contrast to the Can$1 billion in new science funding contained in last year's budget — almost none of which went to basic research.

The 2018 budget is "the single largest investment in investigator-led fundamental research in Canadian history", said finance minister Bill Morneau in remarks to legislators on 27 February.

The Natural Sciences and Engineering Research Council and the Canadian Institutes of Health Research will each receive Can$354.7 million, and the Social Sciences and Humanities Research Council will get Can$215.5 million. All three councils will share another Can$275 million to support research that is "international, interdisciplinary, fast-breaking and higher-risk".

The move follows recommendations from last year's Fundamental Science Review, a report by an expert panel led by David Naylor, former president of the University of Toronto. He was "relieved and pleased" with this "historic recalibration" in science funding.

Research infrastructure gets Can$763 million extra over five years, and a pledge of permanent government funding. And early-career scientists receive a further Can$210 million, also over five years, through a programme that supports researchers at universities across the country.

But scientists didn't get everything they wanted. For instance, there was no new money for the Climate Change and Atmospheric Research programme. Without an influx of cash, several of its research stations in the high Arctic will have to shut down.

Despite that, this budget is a testament to the campaign waged by Canadian researchers over the past year to ensure that the government took the recommendations in the Fundamental Science Review seriously, says Katie Gibbs, executive director of the science campaign group Evidence for Democracy in Ottawa. "It really shows the government spent the last year listening to the community." ■