Morrison has rejected this idea. He says Australia is on track to meet the target it announced before the Paris conference: to cut emissions by 26–28% below 2005 levels by 2030.

But there is little evidence to suggest the government will be able to meet this target without new policies. In August, government advisers said it was unlikely that the electricity sector, responsible for one-third of Australia's emissions, would reduce its emissions by 26% unless a policy was introduced to drive cleaner energy generation over the next decade.

ON THE RISE

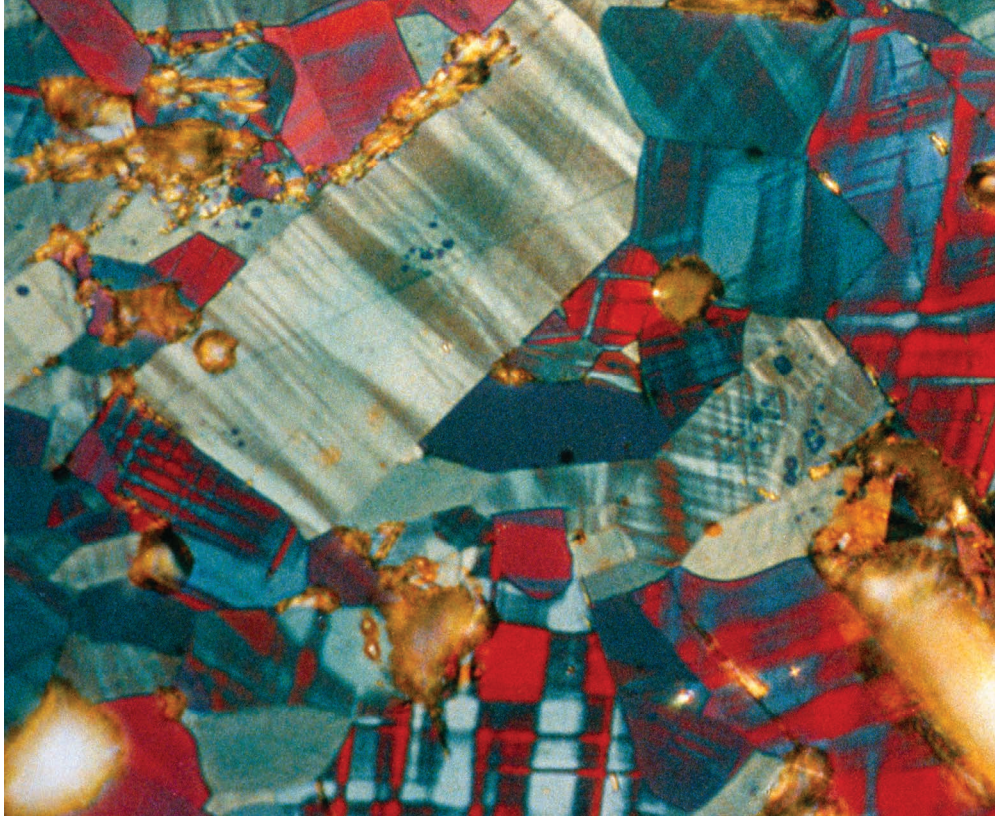
National emissions have risen each year since 2014, when the government repealed laws requiring big industrial emitters to pay for their emissions. There are also no significant policies to reduce the other major sources of pollution, such as transport, agriculture, heavy industry and mining, which together generate nearly two-thirds of Australia's carbon emissions.

Although the NEG was a modest policy, proposed after several more-effective schemes failed to win political support, it had the potential to win the backing of the centre-left opposition Labor Party, says John Church, a specialist in sea-level rise at the Climate Change Research Centre (CCRC) at the University of New South Wales in Sydney. That would have enabled the policy to pass through parliament and into law. The policy also had the support of the business community, which has been calling for climate and energy strategies that encourage investment in new and cleaner power plants, he says. "Walking away from it was a disaster."

Sarah Perkins-Kirkpatrick, an authority on heatwaves, who is also at the CCRC, says government motivation to do something about climate change seems to have disappeared altogether. When she briefed senior officials on the latest climate-change science in August, she left the meeting feeling optimistic that more policies were coming. "People were trying to get things done, but now that's not the case at all," she says. "I'm extremely frustrated."

The decision to drop the policy also goes against the public's support for action on climate change, says Hughes. A poll of 1,756 people, published on 12 September by research and advocacy organization the Australia Institute, found that 73% of respondents were concerned about climate change and 68% wanted domestic climate targets in line with the country's Paris commitment.

But Australia's lack of climate policy could be short-lived. A national election is due by May 2019, and recent polls suggest that the Labor Party, led by former union boss Bill Shorten, is favoured to win. Labor says it would set a new emissions target of a 45% cut by 2030, although it has not revealed how it would reach this goal. In the meantime, some states have mandated ambitious renewable-energy targets, and business leaders say investment in clean energy is increasing because it is now the cheapest option. ■



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PHYSICS

AI spots pattern in superconductor data

Machine learning might one day boost efforts to make sense of other baffling quantum systems.

BY ELIZABETH GIBNEY

Machine-learning algorithms are helping to unravel the quantum behaviour of a type of superconductor that has perplexed physicists for decades.

Researchers used artificial intelligence (AI) to spot hidden order in images of a bizarre state in high-temperature superconductors.

The result, published in a preprint[1] on the arXiv server last month, supports one theory in a decades-long attempt to understand these materials.

The study also represents the first time that machine learning has been successfully used to make sense of experimental data on quantum matter, said Eun-Ah Kim at Cornell University in Ithaca, New York, who presented the work at a meeting on Materials and Mechanisms of Superconductivity and High Temperature Superconductivity in Beijing in August.

In the long term, machine learning might boost efforts to spot simple patterns in other noisy and chaotic experimental systems, such as quantum spin liquids, which could form the basis of a future exotic type of quantum computer.

The latest study focused on superconductors, which conduct electricity without any electrical resistance, but typically do so at less than 4 degrees above absolute zero, around −269 °C. Kim's team examined an even more rarefied group, called cuprates, which are made of sandwiches of copper oxide and become superconducting at temperatures up to −140 °C. Understanding the reason that cuprates can superconduct could be the key to engineering materials that do so closer to room temperature.

MYSTERY STATE

But things get particularly baffling when cuprates enter a state called the pseudogap, which occurs when the materials are close to superconducting. Complex interactions between electrons and atoms make the pseudogap difficult to describe theoretically and its chaotic nature challenging to observe. Some physicists call this state the cuprates' 'dark matter', yet explaining the pseudogap may be key to understanding superconductivity.

Physicists have observed some promising signs of order in the pseudogap — visible as ripples of changing electron density — but

Micrograph of yttrium barium copper oxide, a high-temperature superconductor.

they disagree on how to explain these patterns. One approach views electrons as strongly interacting particles[2,3], whereas the other treats them as wave-like and only weakly interacting.

To glean more information about these patterns, Kim's team designed neural networks — AI inspired by structures in the brain — that studied images of the pseudogap. Patterns in the images, taken with a scanning tunnelling microscope, often seem disordered to the human eye because of the material's naturally chaotic and fluctuating nature, and noise in the measurements. The advantage of machine learning in this situation is that algorithms can learn to recognize patterns that are invisible to people.

PATTERN RECOGNITION

To train the algorithms, the team fed neural networks examples of rippled patterns that corresponded to different theoretical predictions. Having learnt to recognize these examples, each algorithm applied this learning to real data from cuprates in the pseudogap. Over 81 iterations, the algorithms repeatedly identified one modulating pattern that corresponded to the particle-like description of electrons, which dates back to the 1990s.

The team's paper shows that the particle-like description is more appropriate in this case than is the conventional wave-like description, says André-Marie Tremblay, a physicist at the University of Sherbrooke in Canada, who was at Kim's talk in Beijing. Working out the nature of the patterns is crucial to interpreting what causes them, says Milan Allan, a physicist at Leiden University in the Netherlands.

The technique could eventually help physicists to understand high-temperature superconductivity, says Allan, although he cautions that the paper is far from definitive and that debate about what the pseudogap is will continue.

The work is an impressive, original application of machine-learning algorithms to this type of experimental data, says Tremblay. But the algorithm can only distinguish between the various hypotheses it is given, he says, rather than find entirely new patterns.

During her talk, Kim said that work is under way to apply the technique to rapidly make sense of data from the X-ray diffraction of quantum materials — a technique that uses the scattering of electromagnetic waves to reveal a material's 3D physical structure, but which creates patterns so rich that they can take months to unravel by conventional means. In this case, the AI must draw out similarities and classifications itself, rather than be given pre-labelled examples, by grouping features that it sees as similar. "This journey of using AI, or machine learning, for various aspects of our quest to understand quantum emergence has just begun," said Kim. ■

1. Zhang, Y. *et al.* Preprint at https://arxiv.org/abs/1808.00479 (2018).
2. Kivelson, S. A., Fradkin, E. & Emery, V. J. *Nature* **393**, 550–553 (1998).
3. Zaanen, J. *Science* **286**, 251–252 (1999).

GENDER BIAS

Peer review fails equity test

Analysis of submissions to eLife *reveals a gender gap in whom journals invite to do reviews.*

BY DALMEET SINGH CHAWLA

Women are inadequately represented as peer reviewers, journal editors and last authors of studies, according to an analysis of manuscript submissions to an influential biomedical journal.

The study looked at all submissions made to the open-access title *eLife* from its launch in 2012 to 2017 — nearly 24,000. It found that women worldwide, and researchers outside North America and Europe, were less likely to be peer reviewers, editors and last authors. The paper — which hasn't itself yet been peer-reviewed — was posted on the preprint server bioRxiv on 29 August (D. Murray *et al.* Preprint at BioRxiv https://doi.org/10.1101/400515; 2018).

About 7,000 of the submitted studies went through the full submission process (at *eLife*, authors make a 'pre-submission query' before being invited by the journal to send a full paper — a relatively uncommon practice among journals). In all, the analysis covered the activity of about 7,000 referees, 890 reviewing editors and 57 senior editors.

The researchers found that women make up only 21% of peer reviewers, and around one in four reviewing editors. Most reviewing editors and peer reviewers were based in the United States — 62% and 56%, respectively ▶

SOURCE: D. MURRAY *ET AL.* PREPRINT AT BIORXIV HTTPS://DOI.ORG/10.1101/400515 (2018).

PEER-REVIEW PATTERNS

An analysis of thousands of submissions to the journal *eLife* — in which peer-review panels openly discuss submitted works — found that all-female reviewer groups accepted more manuscripts with female last authors than did all-male panels.