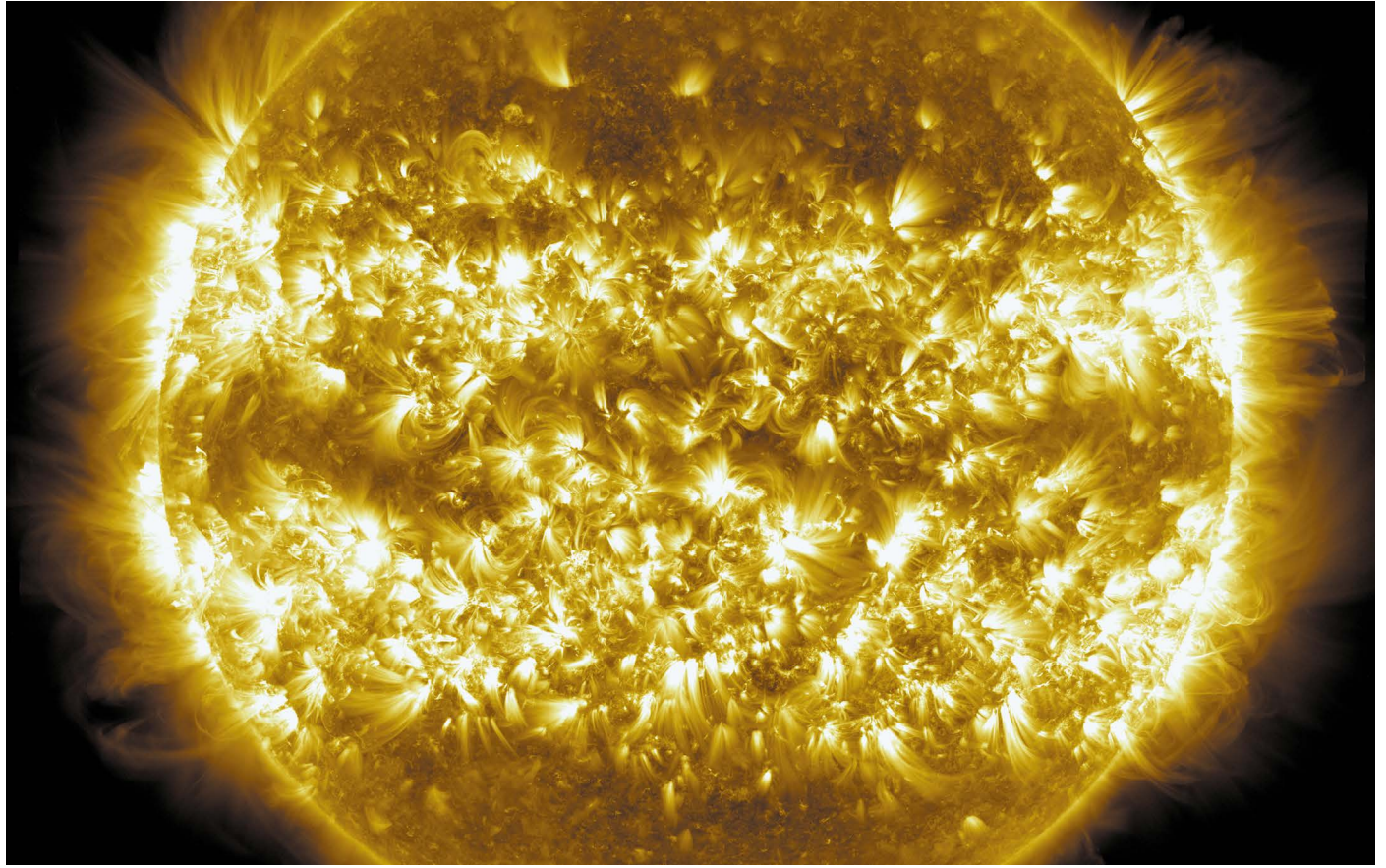


# News in focus



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Charged particles flow around and away from the Sun. Those that reach Earth can disrupt radio communications.

## SUN-BOMBING CRAFT UNCOVERS SECRETS OF THE SOLAR WIND

Surprise magnetic reversals and a fast rotating wind mark the first findings from NASA's Parker Solar Probe.

By Alexandra Witze

**A** spacecraft buzzing past the Sun has caught the best-ever glimpse of the birthplace of the solar wind – the stream of energized particles that floods outwards from the star.

NASA's Parker Solar Probe spotted strange spikes in the wind, where particles speed up and flip the direction of the wind's magnetic field. The spacecraft also observed the wind rotating around the Sun faster than expected – suggesting that scientists' understanding of how stars' rotation slows down

as they age could be wrong.

The findings, described in four papers published on 4 December in *Nature*<sup>1-4</sup>, could help researchers to better prepare for periods when the solar wind is particularly turbulent and knocks out radio and other communications as it washes over Earth. They are the first discoveries from the Parker Solar Probe, which launched in 2018 and has made three circuits around the Sun so far.

"We're seeing terrific new plasma astrophysics in action, right from the beginning," says Stuart Bale, a plasma physicist at the University of California, Berkeley. "It's been spectacular."

The Parker Solar Probe is gradually drawing closer to the Sun as it loops around the star. The most recent encounter was in September, and the next is expected in January. "We're observing in a regime that we've only speculated about before now," says Sarah Gibson, a solar physicist at the National Center for Atmospheric Research in Boulder, Colorado. The probe is studying the energy that heats the Sun's outer atmosphere, or corona, and accelerates the solar wind.

Although scientists can study the solar wind as it flows over Earth, doing so is like trying to study the origin of a waterfall from halfway

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down the cliff over which it pours, says Bale. “If you want to know the source, you have to get up there and get closer – is it coming from one hole in the ground? From a bunch of seams in the rocks? Is there a sprinkler system up there?”

The Parker Solar Probe measured a portion of the solar wind coming from a small hole in the Sun’s corona near the equator<sup>1</sup>. It is the closest look yet at one of the solar wind’s points of origin.

The spacecraft also found that, as the wind streams out into space, parts of it race ahead in high-velocity spikes. “I think of them as rogue waves,” says Justin Kasper, a space scientist at the University of Michigan in Ann Arbor. Within these waves, the speed of the solar wind doubled, and the strong flow temporarily reversed

**“We’re seeing terrific new plasma physics in action, right from the beginning.”**

the wind’s magnetic field<sup>3</sup>. The probe flew through more than 1,000 of these spikes each time it zipped past the Sun, Kasper says. Scientists don’t yet understand what causes them.

Another surprising finding is how quickly the solar wind rotates around the Sun as the star spins. Models suggest that the wind flows in this direction at a speed of a few kilometres per second – but the Parker Solar Probe measured it moving at around 35 to 50 kilometres a second.

The discovery has major implications. Knowing that the wind is rotating at a different speed from expected could help researchers to improve predictions of when a dangerous solar outburst might reach Earth. The finding also suggests that the solar wind is transporting more energy away from the Sun than previously thought, so the star’s rotation might be slowing more rapidly than expected. If so, astronomers might need to revise their ideas about how other stars in the Universe age.

So far, the Parker Solar Probe has studied only a small portion of the Sun at close range. More observations are needed to confirm the unexpectedly fast rotation speed of the solar wind, says Adam Finley, an astronomer at the University of Exeter, UK.

There’s plenty more time for discovery. By the end of its mission in 2025, the probe will have had 24 close encounters with the Sun – getting more than three times closer to the star than it has so far.

1. Bale, S. D. et al. *Nature* <https://doi.org/10.1038/s41586-019-1818-7> (2019).
2. Howard, R. A. et al. *Nature* <https://doi.org/10.1038/s41586-019-1807-x> (2019).
3. Kasper, J. C. et al. *Nature* <https://doi.org/10.1038/s41586-019-1813-z> (2019).
4. McComas, D. J. et al. *Nature* <https://doi.org/10.1038/s41586-019-1811-1> (2019).

# CHINESE MINISTRY INVESTIGATES IMAGES IN TOP ACADEMIC’S PAPERS

Four journals also say they are examining articles co-authored by university president Cao Xuetao.



Cao Xuetao has been a prominent voice for strengthening research integrity in China.

By Andrew Silver

**T**he Chinese education ministry is investigating scientific articles authored by high-profile immunologist and university president Cao Xuetao, following suggestions that dozens of papers contain potentially problematic images. Four journals also say they are examining papers from Cao.

The scrutiny comes after US microbiologist Elisabeth Bik raised concerns three weeks ago on Twitter and the post-publication peer-discussion site PubPeer about images in papers written by Cao and his group.

Cao is the president of Nankai University in Tianjin, and his team has pioneered the development of cancer immunotherapies in China. He says that his group is investigating the papers in question, and he is confident that the issues raised do not affect the papers’ conclusions. Cao has been a prominent voice for strengthening research integrity in China, and gave a speech on the topic at the prestigious Great Hall of the People in Beijing in November.

Bik has flagged up potential problems in about 50 papers co-authored by Cao on PubPeer, and other users, most of them anonymous, have raised similar issues concerning another handful of papers from the group. As *Nature* went to press, images in 63 papers that the team has published in 28 journals since

2003 have been flagged on the site.

In some papers, Bik says, seemingly identical images are labelled as representing different biomedical experiments. In others, features such as patterns of dots that represent biological data seem to be “unexpectedly” duplicated in the same image, she says.

“That would be the equivalent of someone showing you a photo of the night sky, and you would see two Big Dipper constellations in the same photo,” says Bik, who has developed a reputation for spotting and raising potential problems in scientific images and figures.

During a press conference on 22 November, Xu Mei, a spokesperson from China’s Ministry of Education, said the ministry is investigating the articles in question and the “relevant” institutions. Cao is also director of the Institute of Immunology at the Second Military Medical University in Shanghai, also known as the National Key Laboratory of Medical Immunology. Most of the 63 articles list this affiliation.

Representatives from 4 of the 28 journals concerned – *Science*, *Nature Communications*, *Cardiovascular Research* and *Molecular Immunology* – told *Nature* that they had heard about the potentially problematic papers in their journals and were reviewing them.

Bik told *Nature* that she cannot comment on whether the issues she’s flagged up are the result of research misconduct. “It is up to the affiliated institutions to investigate and conclude,” she