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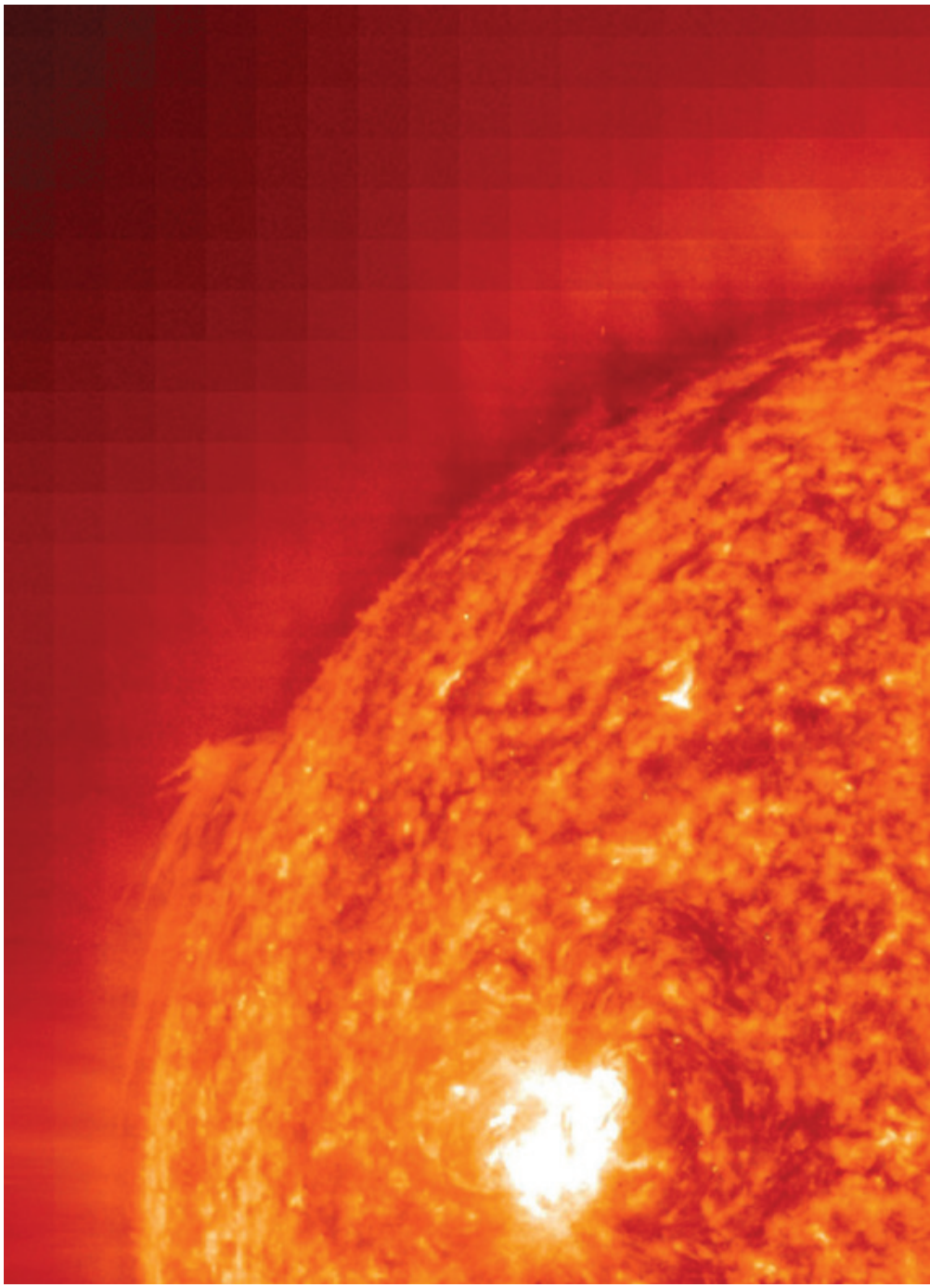
Earth may soon get early warning of dangerous solar activity



DETLEV VAN RAVENSWAAY/ Science Source

SOLAR FLARES ARE BURSTS of radiation from the sun's surface, sometimes followed by a bubble of magnetized plasma particles called a coronal mass ejection (CME). If they happen to spray out in Earth's direction, CMEs can cause geomagnetic storms that damage power systems on the ground or spacecraft in orbit. And solar flare radiation itself can disrupt communication networks and satellite operations.

Unfortunately, solar scientists cannot reliably predict when the sun will belch out a flare. After one is observed, every minute counts in the ensuing scramble to adjust power grids or move satellites before they get damaged.

Now researchers have used data from NASA's Solar Dynamics Observatory to show that distinctive flickering in the huge loops of roiling plasma that arch up out of the sun's atmosphere, called the corona, seems to signal that a large flare could soon occur. This link could help researchers brace for the flare and look out for signs that an incoming CME could hit Earth within a couple of days.

Emily Mason, a heliophysicist at San Diego-based research firm Predictive Science, and her colleagues observed coronal loops in magnetically active regions where 50 strong solar flares occurred. They found that the loops' ultraviolet light output varied erratically a few hours before a flare, the team told a recent meeting of the American Astronomical Society in Maryland. "It gives us one to two hours' warning, with 60 to 80 percent accuracy, that a flare is coming," Mason says.

"If we want to be able to predict solar storms earlier, then we have to predict when the flare will happen," says Mathew Owens, a space physicist at the University of Reading in England. "Small gains there are valuable."

Crucially, the researchers used a near-real-time data stream with just an hour's lag rather than working with data that have been processed to improve quality, which can take weeks. Mason and her team observed flares on the sun's outer edges from our perspective, or limbs, because that is where their light can best be seen from

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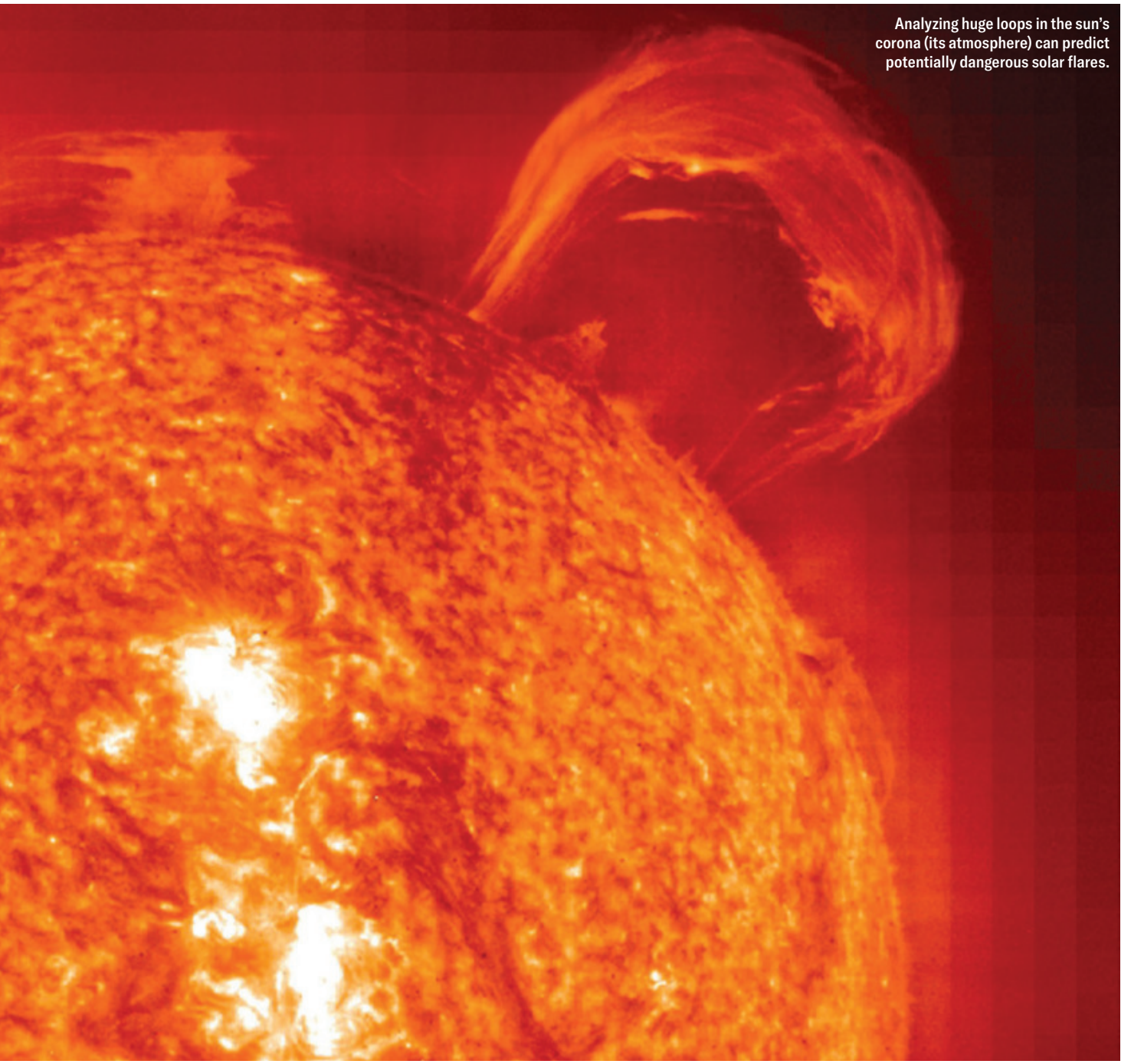

Analyzing huge loops in the sun's corona (its atmosphere) can predict potentially dangerous solar flares.

Earth. Flares on the sun's eastern limb will head away from Earth as the sun rotates, but those on the western limb may hit the planet's atmosphere, Mason says.

For now our viewpoint means we can't easily see loops emanating from elsewhere on the sun. But the European Space Agency is planning to launch a spacecraft called Vigil in 2031 that should give us a side-on perspective. "Being able to see the sun from more different angles is the single most important thing that we can do to improve our predictions," Mason says. She hopes predicting big flares can help keep astronauts and electrical systems safe. —*Chris Simms*