Science

Solving the Scorching Mystery of the Sun's Erupting Plasma Jets

Trilobites

By NICHOLAS ST. FLEUR JUNE 23, 2017

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A spectrograph of plasma jets shooting from the sun's surface. NASA IRIS

Spiky bursts of plasma called spicules swirl around the surface of the sun. Millions erupt every moment, spurting solar material some 6,000 miles high at speeds of about 60 miles per second.

"These things are very violent," said Bart De Pontieu, a research scientist with Lockheed Martin Solar and Astrophysics Lab in Palo Alto, Calif. "The gas in spicules is about 10,000 degrees and they travel the length of California in just a minute or so."

Scientists have studied spicules for decades, but were not sure how the plasma jets formed. Now, Dr. De Pontieu and his colleagues think they have solved the searing mystery. They published their findings Thursday in the journal Science.

Using data gathered by high-powered land and space telescopes, they created a computer simulation that reconstructed the conditions between the sun's surface and its atmosphere, where spicules form.

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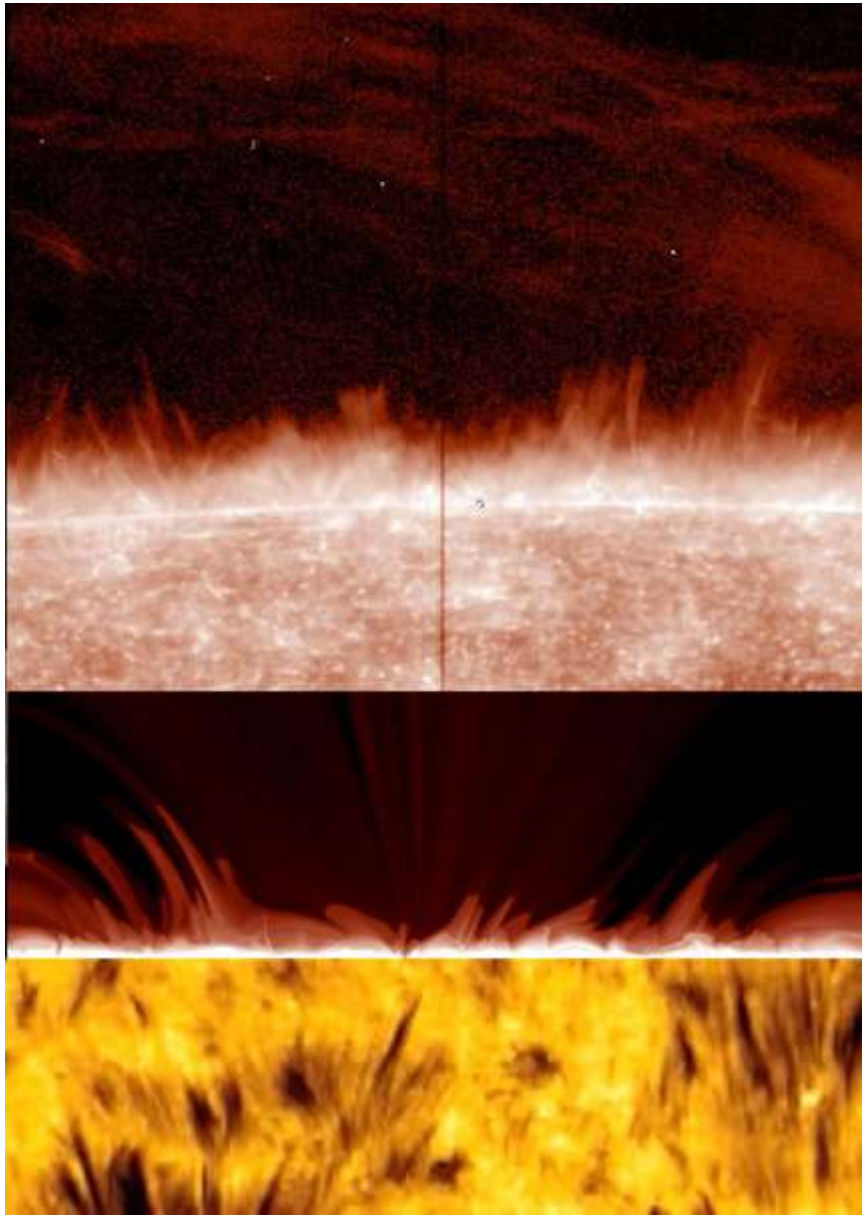
Powerful magnetic fields are created in the interior of the sun. There, the high density keeps them tangled and tamed. But near the surface, the magnetic fields can use neutral particles, atoms that do not carry an electric charge, to diffuse into the sun's atmosphere. The fields enter a reddish layer called the chromosphere where their violent nature is unleashed.

Photo



Jets of solar material called spicules shoot out from the sun. Credit NASA IRIS spectrograph, Bifrost code developed at the University of Oslo, and and Swedish 1-m Solar Telescope

"It's a sling shot effect," said Mats Carlsson, a professor of astrophysics at the University of Oslo in Norway, and co-author of the paper.

The density in the chromosphere is significantly lower than in the sun's interior, so the magnetic fields are no longer suppressed and are able to straighten out. As they unwind and release their tension, they fling hot plasma at incredible speeds, creating the spicules. The spicules surge thousands of miles high, passing through the chromosphere and into the sun's corona before collapsing.

To create a computer simulation that accurately reflected what was happening on the sun, Dr. Carlsson said they needed to incorporate the effects of neutral particles. In earlier simulations they did not differentiate neutral particles from charged particles in the sun. Those models made it seem as if the edge between the sun's atmosphere and surface was fully electrically charged.

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