Is it a bird, a plane, a UFO? It's a...red sprite

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Red sprites, these strange lights in the sky are called; they form above thunderstorms. Credit: Jason Ahrns

Is it a bird, is it a plane, is it a UFO? Strange lights in the sky are being closely watched by atmospheric scientists.

Dubbed red sprites by researchers, these dancing fairies-of-the-clouds are sometimes glimpsed as blood-red bursts of light in the shape of jellyfish.

At other times, they appear as trumpet-shaped blue emissions, called blue jets. Like the most elusive of nymphs, however, red sprites and blue jets come out on only one occasion: during severe thunderstorms.

Although sporadically reported for years by airline pilots, only in the past decade or two has there been enough evidence to convince atmospheric scientists to investigate the phenomenon.

What's that in the skies?

Now baffled researchers asking "What in the world is this?" may have found answers.

Above a thunderstorm's black clouds, sprites appear as bursts of red light flashing far into Earth's atmosphere, according to scientist Hans Nielsen of the University of Alaska at Fairbanks.

The brief flashes look like glowing jellyfish, with red bells and purple tentacles. In a single night, a large thunderstorm system can emit up to one hundred sprites.

Into the wild blue—or red—yonder

Nielsen, Jason Ahrns, also of the University of Alaska at Fairbanks, Matthew McHarg of the U.S. Air Force Academy and researchers from Fort Lewis College teamed up this summer to study sprites.

They used the National Science Foundation (NSF)/National Center for Atmospheric Research Gulfstream-V aircraft, a high-flying plane capable of reaching altitudes of 50,000 feet, to conduct their research. Their project is funded by NSF.

Sprites are similar to lightning, say Nielsen and McHarg, in that they are electrical discharges from the atmosphere.

But while sprites mimic lightning "in some ways," says McHarg, "they're different in others. Lightning happens below and within clouds, at altitudes of two to five miles. Sprites occur far above the clouds, at about 50 miles up—10 times higher than lightning."

One-one thousandth of a second: How long red sprites last, faster than our blinking time. Credit: Jason Ahrns

They're also huge, he says, reaching 30 miles high.

"Red sprites don't last very long, though, about one-one thousandth of a second. That's 300 times quicker than the time it takes us to blink!"

Blue jets, which weren't directly part of the scientists' study, stick around longer than red sprites, originate at the tops of storm clouds, and shoot up to an altitude less than half that of red sprites. Blue jets are narrower than red sprites, and fan out like trumpet-shaped flowers in blue or purple hues.

"This field of research is fast evolving, and is important for understanding the global electric circuit," says Anne-Marie Schmoltner, program director in NSF's Division of Atmospheric and Geospace Sciences, which supports the research. "The red sprite airborne field campaign this summer provided observations at unprecedented time resolutions."

What makes thunderstorms' celestial lights

Atmospheric researchers have developed theories to try to explain these celestial lights.

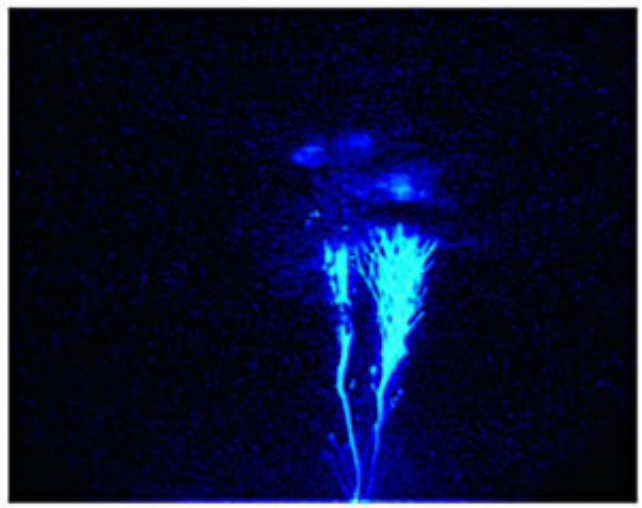
Red sprites may happen at the time of positively charged cloud-to-ground lightning strikes, which make up about ten percent of all lightning and are many times more powerful than more common, negatively charged lightning.

The flashes may be akin to giant electric sparks.

After a powerful ground strike, the electric field above a thunderstorm may become strengthened to the point that it causes an "electrical breakdown," an overload that weakens the atmosphere's resistance to electric current flow. The result is an immense red spark, or sprite, in the atmosphere.

Although still something of a mystery, red sprites have helped solve other long-standing questions.

Scientists have found that red sprites create some of the low-frequency radio bursts picked up for years by instruments around the world, but whose source was unknown.



Other NSF-funded research has tracked blue jets, close relatives of red sprites. Credit: Stanford University

Large bursts of gamma rays, emanating from Earth rather than space, originate during thunderstorms, although their exact relationship to red sprites remains unclear.

Researchers now wonder whether red sprites (and blue jets) might affect the atmosphere in important ways.

For example, sprites and jets might alter the chemical composition of the upper atmosphere. Though brief, they could set off lasting charges.

Sprites' deep red color is caused by the light emitted from nitrogen molecules in the atmosphere, says McHarg. Red sprites may turn out to

be important to atmospheric chemistry and global climate by changing concentrations of nitric oxides high in the atmosphere.

The researchers are using a technique called high-speed spectroscopy to study sprites' different colors to determine the amount of energy the sprites carry, and to find out more about their chemical composition.

How to see a sprite

Can thunderstorm-watchers on the ground glimpse red sprites and blue jets with the naked eye? Yes, if they know where to look.

Viewers must be able to see a distant thunderstorm with no clouds in the way, in an area without city lights. Then they must look above the storm, not at the lightning within the clouds.

It's likely, say the scientists, that if watchers wait long enough, they'll see a red sprite. Blue jets are more elusive. The best viewing would probably come from a plane flying very high, and located miles and miles away from a thunderstorm.

With its rubber tires, a car may be the safest vehicle from which to hunt for ephemeral sprites of the thunderclouds.

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