# It looks like an aurora, but STEVE still hasn't been figured out

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Alberta Aurora Chasers capture STEVE, the new-to-science upper atmospheric phenomenon, on the evening of April 10, 2018, in Prince George, British Columbia, Canada. In a second study of mysterious phenomena, researchers discovered that solar particles hitting the ionosphere do not power the violet, vertical streaks. Photo by: Ryan Sault

A fascinating cosmic event has a rather unassuming name: STEVE.

This name was given to strange purple ribbons of light that seem to accompany auroras. The Northern Lights is an example of an aurora, a natural night-sky phenomenon that often features grand, wispy displays of slime-green light.

It turns out that STEVE is even weirder than we thought, a new study suggests.

In 2016, members of the Alberta Aurora Chasers Facebook group noticed violet-colored stripes of light across beautiful shots of swirling auroras posted online. Upon further investigation, the group found them in images spanning the last few decades. With typical Internet logic, they decided to name the phenomenon "Steve" after a joke in the cartoon movie "Over the Hedge."

Scientists later turned the name into an acronym, dubbing the ribbons STEVE, which stands for Strong Thermal Emission Velocity Enhancements.

It turns out the glowing bands are not auroras at all. They're something completely unknown, researchers determined, in only the second study ever done on the phenomena.

## Researches Still Pondering Mysterious Purple Light

So, if STEVE isn't an aurora, what is the mysterious purple light? It's hard to say.

Sarah Lewin at Space.com reports that skywatchers at first believed the lights were proton arcs, which are a type of aurora.

However, Eric Donovan, a physicist at University of Calgary and co-author of the new study in Geophysical Research Letters, notes that protons, the positive-charged particles of an atom, create a very diffuse light that is barely picked up by cameras. STEVE, on the other hand, is very bright.

The researchers really don't know yet where the purple one gets its energy. "Interestingly, its skyglow could be generated by a new and fundamentally different mechanism in the ionosphere," they said. The ionosphere refers to an upper layer of the earth's atmosphere that is full of charged, electric particles.

Auroras — both the aurora borealis in the Northern Hemisphere and aurora australis in the Southern Hemisphere — light up when solar wind and solar flares from the sun blow energetic, charged plasma particles through space to Earth. Near the poles, plasma particles evade Earth's magnetic field, which is usually strong enough to deflect most of those particles. When the particles interact with oxygen, they produce the classic green glow. The lights turn red if the particles mix with high-altitude oxygen or blue or purple if they excite nitrogen.

In the latest study, researchers wanted to see if the same conditions that produce auroras also produce STEVEs. They compared images of a STEVE from March 2008 captured using ground-based cameras with images gathered by the National Oceanic and Atmospheric Administration's  Polar Orbiting Environmental Satellite 17. It had passed over the same area and collected data about the ionosphere.

## STEVE Is Labeled A "Skyglow"

The data show that the STEVE appeared at a time when charged particles were not deluging the ionosphere. This may be a clue that the same process that powers aurorae does not bring STEVEs to life. Instead, it's a distinct phenomenon from an aurora that, for now, is simply classified as a "skyglow."

"Our main conclusion is that STEVE is not an aurora. So right now, we know very little about it. And that's the cool thing," physicist Bea Gallardo-Lacourt, also of the University of Calgary and lead author of the study, tells the Canadian Broadcasting System's  Stagg.

STEVE doesn't behave much like an aurora either. Instead of shimmering in the sky in a diffuse horizontal glow, STEVEs are narrow vertical bands that pierce the sky — sometimes stretching 600 miles — like the trail from a giant purple rocket. They are also hot, reaching 5,500 degrees Fahrenheit.

## It Moves "Almost Like A Comet"

"The aurorae you see in the sky, at least from our data, is moving at a certain speed," Gallardo-Lacourt told the CBC. "Then you have this guy moving crazy fast at lower latitudes, passing from east to west, super narrow, almost like a comet."

Gallardo-Lacourt added, "I like to describe it to my friends as the aurora moves like Wile E. Coyote, while Steve moves like the Road Runner."

STEVEs have likely been streaking across the sky for millennia, but it took the development of several new technologies for humanity to notice. Lewin reports that STEVEs are a relatively common phenomenon, but seeing one means being in the right place at the right time. In the last 20 years, Canada has gone from having one whole-sky imager, a camera that take snapshots of the sky every night, to more than 100, which means there's more data about what's going on above us.

In the last decade crowdsourcing tools online have also improved our view of the sky. One is the app Aurorasaurus, in which citizen scientists help map the aurorae, and there are many aurora watching groups on Facebook and other platforms. Donovan tells Lewin that just 15 years ago it would have taken scientists 10 years and $200 million to $300 million to find and study a phenomenon like STEVE.

## Quiz

1 Which of the following statements BEST represents Donovan's approach toward online crowdsourcing tools?

(A) Donovan hesitates to give credit to the crowdsourcing tools because he believes that astronomical discoveries should be done by professional scientists.

(B) Donovan believes that crowdsourcing is the main reason why astronomers have been able to discover aurorae and thinks that all future studies should be done through these tools.

(C) Donovan recognizes that crowdsourcing tools have increased knowledge of astronomical events that otherwise would have been difficult or costly to study.

(D) Donovan fears that crowdsourcing tools are too expensive and are taking away resources from other more important studies on aurorae and STEVEs.

2 How does the article introduce the idea that STEVE is unlike other known astronomical events?

(A) It highlights a study that revealed that STEVEs are brighter than proton arcs.

(B) It quotes an expert who concluded that STEVEs are a new kind of aurora.

(C) It provides an account of how STEVEs appear in different colors than other skyglows.

(D) It summarizes the finding that STEVEs have appeared for more years than other phenomena.

3 Read the following words from the introduction [paragraphs 1-6].

*strange*

*weirder*

*unknown*

How do these words contribute to the tone of the article?

(A) They convey the sense of disdain and disapproval that surround STEVEs.

(B) They convey the sense of seriousness and importance that surround STEVEs.

(C) They convey the sense of fear and trepidation that surround STEVEs.

(D) They convey the sense of mystery and intrigue that surround STEVEs.

4 What is the meaning of the word “deluging” as used in the following paragraph?

*The data show that the STEVE appeared at a time when charged particles were not deluging the ionosphere. This may be a clue that the same process that powers aurorae does not bring STEVEs to life. Instead, it's a distinct phenomenon from an aurora that, for now, is simply classified as a "skyglow.*

(A) absorbing

(B) shielding

(C) breaking

(D) bombarding