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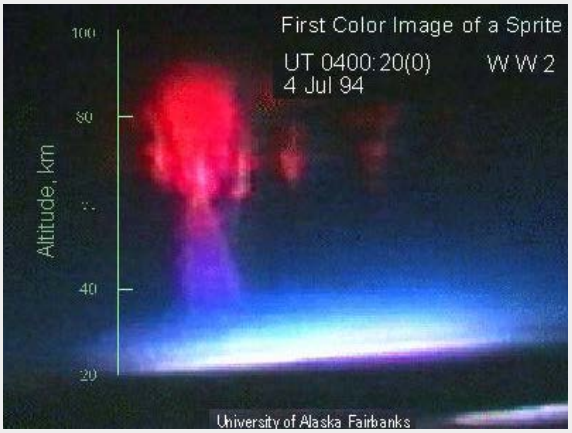
Could Electrical Sprites Hold the Key to Extraterrestrial Life?

by AMY SHIRA TEITEL *on* NOVEMBER 22, 2011

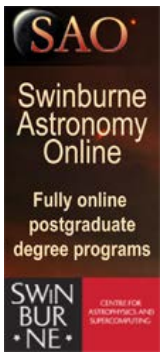


Full color image of a red lightning sprite. Image credit: University of Alaska Fairbanks.

In 1989, meteorologists discovered sprites. Not the spirits, elves, or pixies that pepper Shakespearean comedies but their equally elusive electrical namesakes. Lightning sprites are large scale electrical discharges inside the clouds above storms that make the upper atmosphere glow, sort of like a fluorescent lightbulb.

Meteorologists have already determined that sprites likely aren't unique to Earth. In fact, this elusive form of lightning might be common throughout the solar system. Now, researchers at Tel Aviv University are asking whether the presence of sprites on other planets could indicate the presence of organic material in their atmospheres.

Though not an uncommon phenomena, sprites are incredibly hard to find and observe. They can only be captured with highly sensitive high speed cameras. Sprites occur in the Earth's Mesosphere, layer between the stratosphere and the thermosphere – about 50 km (31 miles) to 90 km (56 miles) high. At



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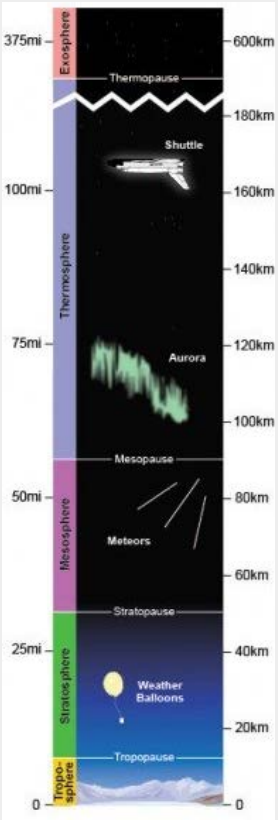


The layers of our atmosphere. Image credit: National Weather Service, JetStream Online School for Weather.

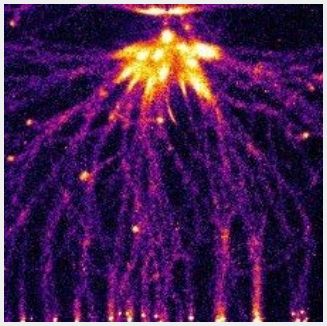
this altitude, the gases that make up our atmosphere are much thinner and unable to hold heat from the Sun making the average temperature a chilly 5°F (-15°C) to as low as -184°F (-120°C).

But gases at this altitude are still thick enough to slow meteors – this is where they burn up and create what we see as meteor showers. Gases in the mesosphere are also thick enough to light up with sprites, providing a window into the composition of our atmosphere. Sprites, which glow reddish-orange, indicate the kinds of molecules present in this layer of the atmosphere.

Lightning isn't a rare occurrence in our solar system, which leads researchers to suspect sprites might be found on Jupiter, Saturn, and Venus – all planets with the right environment for strong electrical storms. Just like on Earth, sprites found on these planets could open a window in their atmospheric composition, conductivity, and possibly point to the presence of exotic compounds.

Jupiter and Saturn present the most exciting environments. Both gas giants experience lightening storms with flashes more than 1,000 as powerful as those found on Earth. It's on these planets that Ph.D. student Daria Dubrovin, with her supervisors Prof. Colin Price of Tel Aviv University's Department of Geophysics and Planetary Sciences and Prof. Yoav Yair at the Open University of Israel, is focussing on.

Dubrovin has re-created these planetary atmospheres in a lab to study the presence of sprites in space. Or, as she describes her work, "We make sprites in a bottle." She hopes this will provide a new understanding of electrical and chemical processes on other planets.



A sprite as it might appear in Saturn's atmosphere, created in a TAU lab. Image credit: American Friends, Tel Aviv University

What's more, understanding lightning on other worlds could help researchers understand the possibility of life on other worlds. As Dubrovin points out, lightning is commonly accepted as the generator of organic molecules that turned early Earth's ocean into the life-filled primordial soup. Increased study of lightning on other planets could give another clue into the presence of extraterrestrial life. Their research could easily be applied to exoplanets, not just bodies in our solar system.

A lightning storm on Saturn has Dubrovin pretty excited. It's currently producing over 100 electrical flashes per second, a rare occurrence even within the planet's volatile cloud layers. If researchers could successfully gather images of higher altitude sprites from the Cassini spacecraft (currently in orbit around Saturn), it would not only yield information on the storm below but also add to the general knowledge base of sprites and lightning on other planets.

Video of Sprites from the University of Alaska

Source: Tel Aviv University

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Torbjörn Larsson Big thanks for this! Having some sort of handle on testing early atmosphere composition after the Earth-Moon impactor is valuable. But, huge typ'Oh here: Now researchers from the New...
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lcrowell Of course if Mars does have a microbial ecosystem it would be madness to terriform the planet. This might see a reverse of HG Wells' "War of the Worlds." Clearly if we were to terriform Mars we...
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Amy Shira Teitel is an historian of spaceflight, blogger, and freelance writer. Her blog, Vintage Space , chronicles her love of space history and manned space exploration. She contributes to Universe Today and motherboard.tv.

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Aqua4U

"...It's currently producing over 100 electrical flashes per second..." (A pun right?) Ahem... lightning on Earth is hot enough (53-54,000* F) to create gamma rays and possibly anti-matter particles right? This is at ~30,000 amperes and 100megavolts... whereas on Saturn the lightning's strength is 10,000 times stronger BUZZZ ZAP! 100 times a second!

THAT would weld your zipper shut... before vaporizing it~

1 week ago 3 Likes Like Reply

Aqua4U

'Cool' fusion anyone? That being... localized 'hot spots' generating fusionable temperatures in chrystaline shaped magnetic compression zones..

1 week ago in reply to Aqua4U Like Reply

Torbjörn Larsson

You can't get 'cold' fusion in a lab even.

'Cool' fusion is the CNO catalytic cycle of large stars.

1 week ago in reply to Aqua4U Like Reply

Aqua4U

These are not 'cold' fusion temperatures.. To me, any unexpected fusion is 'cool'!

1 week ago in reply to Torbjörn Larsson Like Reply

Aqua4U

Tay.. maybe just enough energy to form water molecules... still, that's something!

1 week ago in reply to Aqua4U Like Reply

sharad richardet Dear fraser, I Love This site and how it allows me to keep up to date on space, I mean you add like 5 articles a day, Unfortunately The only Thing that keeps me coming so much is because my life...
5,000,000 Pageviews in November! · 7 hours ago

lcrowell There could be life in liquid that is subsurface, such as what has been found to be flowing out from crater walls.

LC
Microscopic Worms May Help to Colonize Mars · 7 hours ago

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lcrowell

I am presuming that the ionization of molecules is detected here. The ioization of organic molecules might be detectable this way. It is a long shot, particularly if this is proposed with regards to extrasolar planets.

LC

1 week ago 1 Like Like Reply

Aqua4U

Sounds like a job for a radio telescope flotilla at L2? That is... the use of a linked array of ion drive micro *.sats as radiometer or SARS radio receivers? Connect the array to Very Long Baseline Interferometry (VLBI) on Earth... would that provide the resolution? L2 is located 1.5 million kilometers directly 'behind' the Earth as viewed from the Sun . Earth is 12,756.2 kilometers in diameter. a radiometric element of f117.6? Array deployment dependent.

17 hours ago in reply to lcrowell Like Reply

IVAN3MAN_AT_LARGE, Terminator of typographical/grammatical errors.

Yo Amy,

At the sixth paragraph, second sentence: *"Both gas giants experience lightening storms..."*

Must have been *heavy* storms! ;-)

1 week ago 1 Like Like Reply

Bobby Burcham

How about you shut the '****' up?

1 week ago in reply to IVAN3MAN_AT_LARGE 1 Like Like Reply

IVAN3MAN_AT_LARGE, Terminator of typographical/grammatical errors.

How about you tell that to the "Electric Universe" brigade?

1 week ago in reply to Bobby Burcham Like Reply

Torbjörn Larsson

This is what happens when sprites as a phenomena in itself isn't enough to get funding - elusive connections.

> As Dubrovin points out, lightning is commonly accepted as the generator of organic molecules that turned early Earth's ocean into the life-filled primordial soup.

Not unless the ranking has changed since my 2006 reference from astrobiology. And that ranking depends on whether the atmosphere is reducing, intermediate (H2/CO2 ~0.1) or oxidizing:

Source of organics.....Reducing atmosphere.....Intermediate atmosphere
[kg/year]

UV photolysis.....1x10^12.....3x10^8

Comet delivery.....1x10^11.....1x10^11
Impact shocks.....2x10^10.....4x10^2
Meteor shocks.....4x10^9.....8x10^1
Electric discharge.....3x10^9.....3x10^8
Interplanetary dust particles.....2x10^8.....2x10^8
Hydrothermal vents.....1x10^8.....1x10^8
...

The intermediate nearly neutral atmosphere is the likelier condition for early Earth. Then electric discharge is in the major bush league, long after comet delivery, together with photolysis, IDPs and hydrothermal vents.

I see from the ref that Sagan et al arrived at the general result, but the comet delivery and hydrothermal vent contributions are later results. If you squint at Sagan's result, you may claim electric discharge was (barely) "the" major source.

More likely, it is a loose prediction from Miller's experiment. (Already Miller suspected or knew of other sources of natural synthesis IIRC.)

1 week ago Like Reply

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