

OPHIUCHUS SPACEWEATHER FIREWORKS / TRIPLE CONJUNCTION DECEMBER 2006

BUT FIRST, AN AWESOME PLANETARY ALIGNMENT IN OPHIUCHUS 2 YEARS LATER ...



November 29, 2008

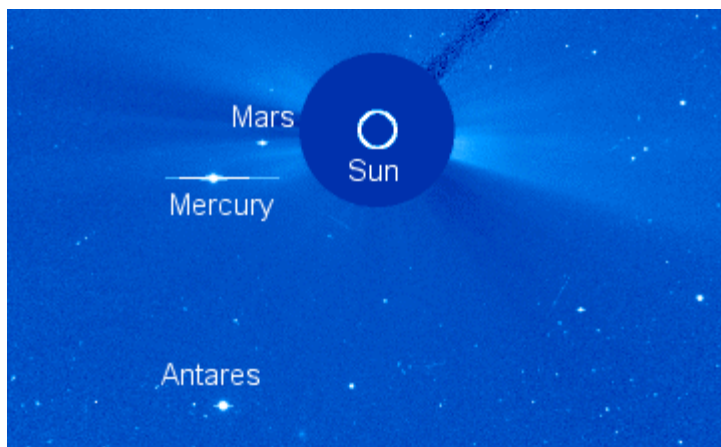


SUNSET PLANETS: When the sun goes down tonight, step outside and look southwest. Venus and Jupiter are having a stunning close encounter in the twilight sky. Paulo Casquinha sends this picture from Langkawi, Malaysia:

"The planets were shining over the main telescope of [Langkawi National Observatory](#)," says Casquinha. "We made the dome 'transparent' by intentionally rotating it during the exposure."

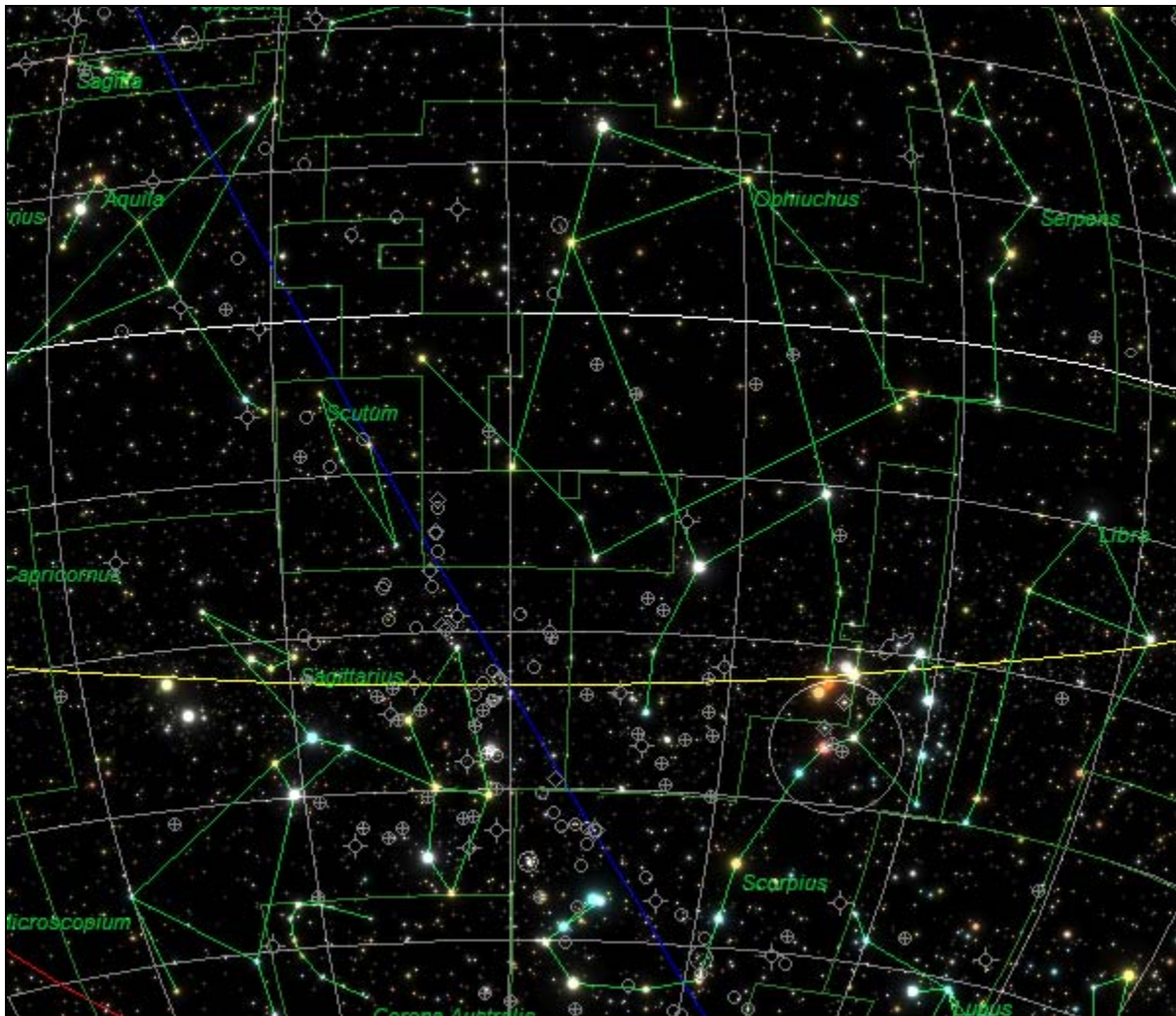
If you're thinking it can't get any better than this, you're wrong. The view is about to improve. On Nov. 30th and Dec. 1st, the crescent Moon will leap up from the horizon, joining Jupiter and Venus in a three-way conjunction that can only be described as the best sky show of the year.

Don't miss a single night: [Nov. 29](#), [30](#), [Dec 1](#).



THE OTHER CONJUNCTION: While all eyes are on Venus and Jupiter in the evening sky, another conjunction is taking place at high noon. Mars and Mercury are having a close encounter of their own within 3° of the sun:

The Solar and Heliospheric Observatory (SOHO) took the picture earlier today. SOHO's onboard coronagraph blocked the glare of the sun to reveal the planets and first-magnitude star Antares nearby. Human eyes cannot see this conjunction--it hurts to look. SOHO images, on the other hand, are utterly painless; [click here](#) for the latest.



“HIGH NOON” AT SAN DIEGO, CALIFORNIA.

What's Up in Space -- 4 Dec 2006

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Did you sleep through [the auroras](#) of November? Next time get a wake-up call: [Spaceweather PHONE](#).

PROMINENCE ALERT: Grab your solar telescope. A large, flame-shaped prominence sprouted out of the sun's eastern limb during the weekend--and it's still there. [Phil Jones](#) of Frisco, Texas, took [this picture](#) using a Coronado [MaxScope90](#).



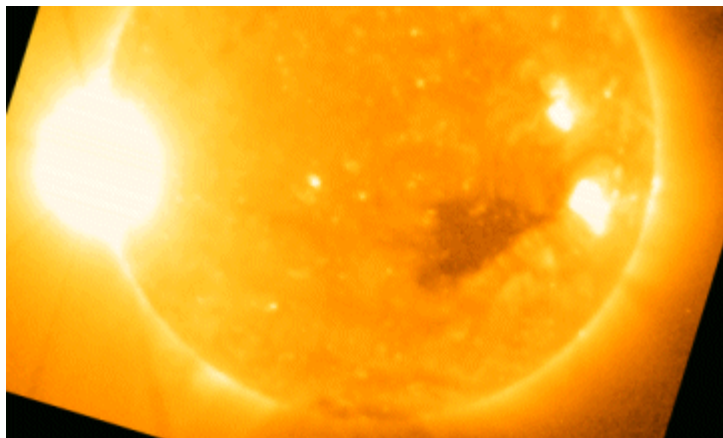
LONG NIGHTS MOON: According to folklore, tonight's full moon is the Long Nights Moon. It gets its name from the long nights of December. There's something special about the Long Nights Moon: it travels extra-high in the sky, passing almost directly overhead at midnight. Go outside and take a look:

Photo details: [Canon 10D](#), [fisheye lens](#), 800 ASA, 6 sec. exp.

In this image from [Peter Detterline](#) of Douglassville, Pennsylvania, the Long Nights Moon is surrounded by a circular [ice halo](#). Crystals of frozen water in high clouds catch the rays of the Moon and bend them as shown.

When you see a Moon halo, be on the lookout for Moon [pillars](#), [dogs](#) and other exotic [arcs](#), too. They're all caused by ice in the sky.

What's Up in Space -- 5 Dec 2006



MAJOR FLARE: Earth-orbiting satellites detected a major [X9-class](#) solar flare this morning at 1035 UT (5:35 a.m. EST). The source: big, new sunspot 930*, which is emerging over the Sun's eastern limb. GOES-13 captured this X-ray image of the blast:

Because of the sunspot's location near the limb, the flare was not Earth-directed. Future eruptions could be, however, because the Sun's spin is turning the spot toward Earth. Sunspot 930 will be visible for the next two weeks as it glides across the solar disk.



***Correction:** Initially, we reported that the X9-class flare came from sunspot 929. The correct number is sunspot 930.

EGYPTIAN TORNADO: Yesterday at the [Bibliotheca Alexandrina](#) in Alexandria, Egypt, astronomer Aymen Ibrahem dashed outside during a rainstorm "hoping to photograph a rainbow." Instead he found himself face-to-face with a rare Egyptian tornado:

"The last tornado in this part of Egypt happened in 1981," says [Ibrahem](#).

Strong tornadoes are born in rotating thunderstorms called [supercells](#). To make a supercell, you need a cold, dry mass of polar air crashing into a warm, moist mass of tropical air. These two kinds of air frequently meet in the mid-section of the United States--hence [Tornado Alley](#). But they rarely meet in Egypt.

Indeed, there was no supercell over Alexandria yesterday. The twister Ibrahem saw was probably a lesser form of tornado called a "funnel cloud," which didn't even reach the ground. Nevertheless, "I was lucky to catch it," he says.

What's Up in Space -- 6 Dec 2006

AURORA ALERT: Sky watchers, be alert for auroras. A solar wind stream hit Earth today, sparking a geomagnetic storm ([in progress](#)) at high latitudes. [John Gray](#) took this picture from the Isle of Lewis, Outer Hebrides, just a few hours ago:

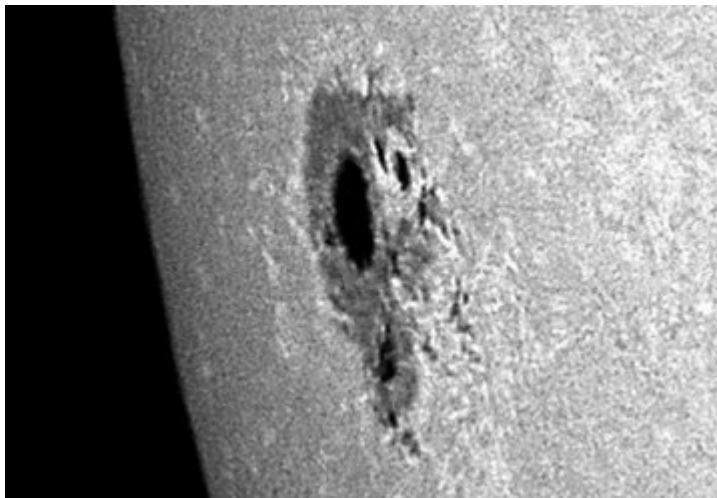


Photo details: [Canon 350D](#), 18mm, f3.5, 400 ASA, 15 secs

"The huge green arch was very impressive," he says. "Even the nearly-full Moon did not stop the auroras from shining through."

Note: The solar wind stream that caused these auroras is unrelated to the solar explosions described below. Consider it a bonus.

ANGRY SUNSPOT: Solar activity is very high. New sunspot 930 has unleashed two [X-class](#) solar flares: an X9-flare on Dec. 5th and an X6- flare on Dec. 6th.



Sunspot 930 on Dec. 6th. Credit: [John Nassr](#) of the Philippines.

Because of the sunspot's location near the eastern limb, the blasts were not squarely Earth-directed. Nevertheless, they might make themselves felt. Coronal mass ejections (CMEs) hurled into space by the explosions could deliver glancing blows to Earth's magnetic field as early as Dec. 7th, producing high-latitude geomagnetic storms.

more images: [from Gary Palmer](#) of Los Angeles, CA; [from Robert Arnold](#) on the Isle of Skye, Scotland; [from Chuck Baker](#) of Carlsbad, California; [from John Nassr](#) of the Philippines; [from John M Candy](#) of Whitley Bay, North Tyneside, UK; [from John Stetson](#) of Falmouth, Maine; [from Adrian Guzman](#) of San Jose, CA.

PLANETARY ALIGNMENT: Finally, a good reason to wake up early: Jupiter, Mercury and Mars are converging to form a tight triangle in the morning sky. Look for them, low in the east, beaming through the rosy glow of dawn on [Dec. 8th](#), [9th](#), [10th](#) and [11th](#). All three planets will fit together in the field of view of ordinary [binoculars](#)--a very pretty sight.

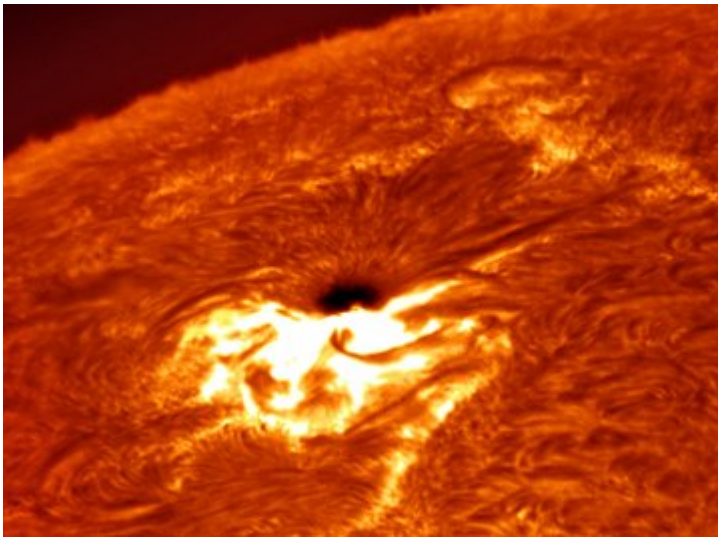
What's Up in Space -- 7 Dec 2006

RADIATION STORM: A radiation storm is [underway](#). Based on the energy and number of solar protons streaming past Earth, NOAA ranks the storm as category [S3](#): satellites may experience single-event upsets and astronauts should practice "radiation avoidance."

The rush of protons may be a sign of an approaching CME (coronal mass ejection). Protons are accelerated in shock waves at the leading-edge of CMEs, so when the proton count rises, we can guess that a CME is en route. Northern sky watchers should remain [alert](#) for auroras, which could flare up if and when a CME arrives.

ANGRY SUNSPOT: Radio astronomer [Thomas Ashcraft](#) knew something was up yesterday when a loud roar came out of the loudspeaker of his 22 MHz shortwave receiver in New Mexico: Sunspot 930 had exploded

again. The [X6](#)-class flare sent shock waves billowing through the sun's atmosphere, producing among other things a Type II solar radio burst: [listen](#).



In Los Angeles, California, [Gary Palmer](#) watched the explosion through his Coronado [SolarMax90](#):

NOAA forecasters estimate a 50% chance of another X-flare during the next 24 hours. Further explosions could intensify the ongoing radiation storm and improve the chances for widespread [auroras](#). Stay tuned.

BONUS: Even between explosions, a lot is happening around sunspot 930, as shown in [this movie](#) from French astronomer [Pascal Paquereau](#). To create the animation, he combined "17 pictures taken every 2 minutes through my Coronado [PST](#)."

PLANETARY ALIGNMENT: Set your alarm. Jupiter, Mercury and Mars are converging, and they can be seen in the eastern sky at dawn shining through the rosy glow of sunrise:

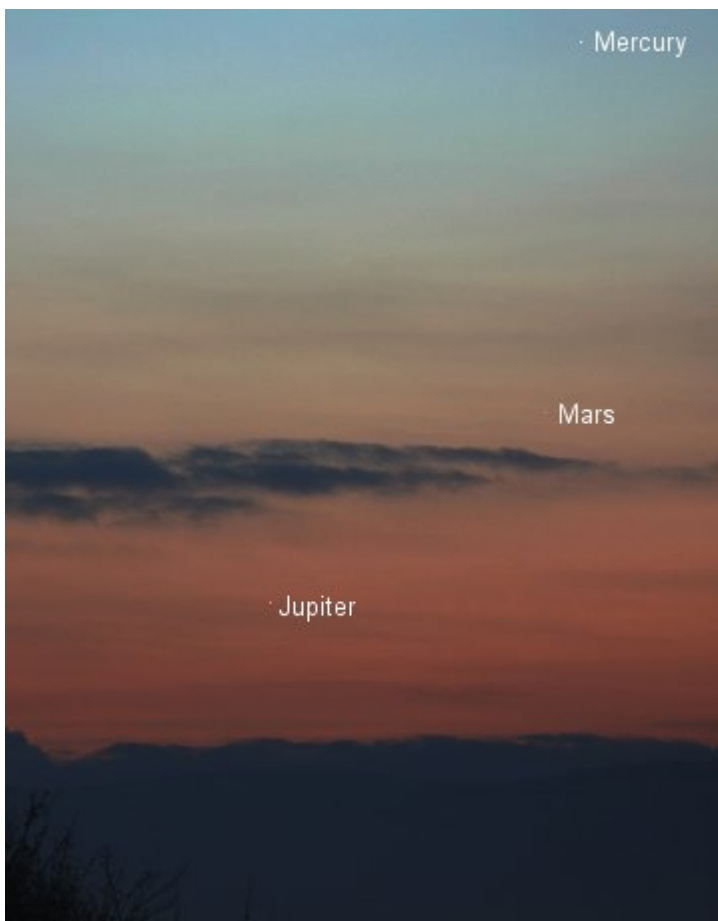


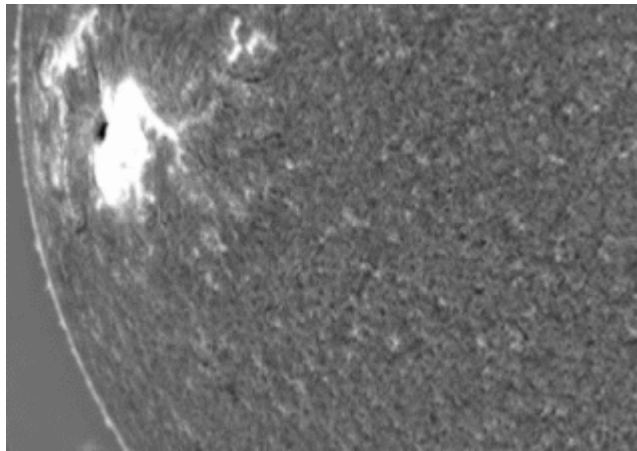
Photo details: [Canon 300D](#), 135 mm lens, 1.3 sec, ISO 200.

Tunz Tezel took this picture from Bolu, Turkey, on Dec. 7th. It merely hints at what is to come in the mornings ahead. On Dec. 9th the three planets will form a tiny triangle about 1° wide. And on Dec. 10th, the best morning of all, Mercury and Jupiter will be less than 0.25° apart. The view through [binoculars](#) should be splendid. Don't miss it! **Sky maps:** [Dec. 8](#), [9](#), [10](#), [11](#).

What's Up in Space -- 8 Dec 2006

PLANETARY TRIANGLE: Set your alarm. Early tomorrow morning, Dec. 9th, Jupiter, Mercury and Mars will gather together in a tiny triangle about 1° wide. Look for them low in the eastern sky beaming through the rosy glow of dawn. The view through [binoculars](#) should be especially fine: all three planets will fit simultaneously in the field of view. [\[sky map\]](#)

SOLAR TSUNAMI: When sunspot 930 exploded on Dec. 6th, producing an [X6](#)-category flare, it also created a tsunami-like shock wave that rolled across the face of the sun, wiping out filaments and other structures in its path. An [H-alpha](#) telescope in New Mexico operated by the National Solar Observatory (NSO) recorded the action:



Credit: NSO/Optical Solar Patrol Network telescope

"These large scale blast waves occur infrequently, however, are very powerful," says Dr. K. S. Balasubramaniam of the National Solar Observatory. "They quickly propagate in a matter of minutes covering the whole sun and apparently sweeping away filamentary material." Researchers are unsure whether the filaments were blown off or were compressed so they were temporarily invisible. Get the [full story](#) from the NSO.

AURORA WATCH: Sky watchers, [be alert](#) for auroras. A coronal mass ejection (CME) is expected to brush past Earth tonight, sparking a mild geomagnetic storm. The display will probably favor high latitudes--e.g., Scandinavia, Canada and Alaska--but it could descend as well to northern-tier US states such as Michigan, Minnesota and Wisconsin. (continued below)



Auroras over Finland on Dec. 8th. Credit: Vesa Särkelä

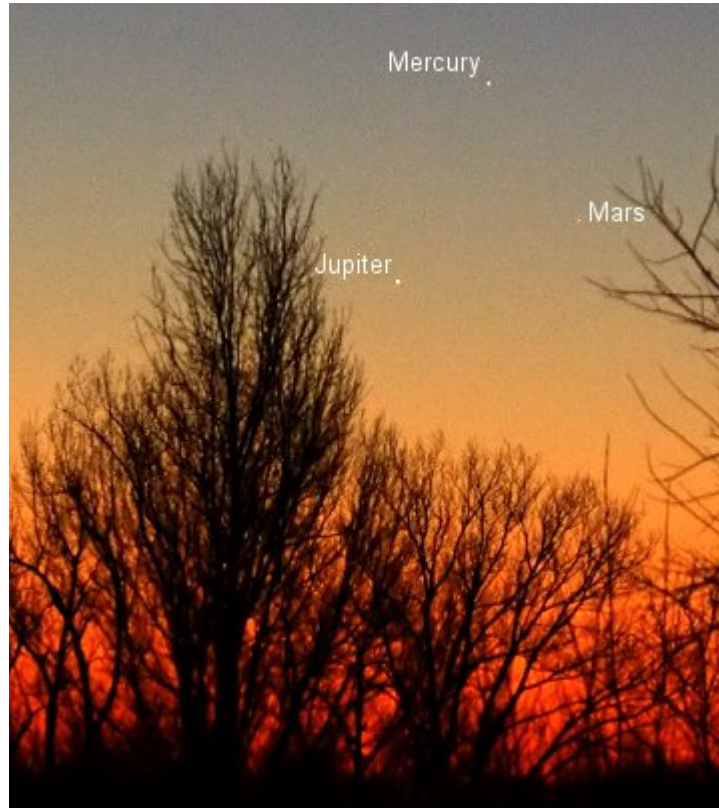
The source of the CME is sunspot 930, which has been exploding regularly since it first appeared on Dec. 5th. The sunspot is slowly turning to face Earth. As it does, it might send more CMEs our way, and they would hit head-on rather than merely brushing past. By next week, Northern Lights could reach deep into the United States. Stay tuned. (And keep your fingers crossed.)

[December 2006 Aurora Gallery](#)

What's Up in Space -- 9 Dec 2006

AURORA WATCH: There is still a chance that an incoming CME will hit Earth today, sparking a geomagnetic storm, but with each passing hour of no impact, the chances increase that the CME has completely missed Earth. Time will tell. Northern sky watchers should remain alert for [auroras](#).

DAWN PLANETS: A suggestion for Sunday morning: Wake up at dawn. Put on warm clothes. Go outside and look east: [sky map](#). (continued below)



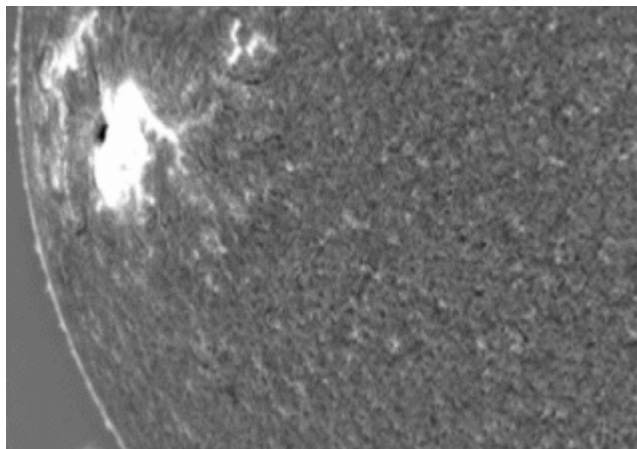
Planets converging on Dec. 9th. Credit: [Tom J. Martinez](#).

There, amid the rosy glow of sunrise, you'll see Mercury and Jupiter so close together, you could hide them behind the tip of your pinky finger held at arm's length. (To be precise, they'll be 0.25° apart.) Look through [binoculars](#) and you'll see dim, red Mars, too. It's a rare three-planet conjunction--don't miss it!

more images: [from Elizabeth Warner](#) of Alexandria, Virginia; [from John Chase](#) near Boulder, Colorado; [from Vincent Jacques](#) near Menton, France; [from Mark Wloch](#) of Erie, Michigan; [from Alan C Tough](#) of Elgin, Scotland; [from Patrick Malriat](#) of Doylestown, Pennsylvania; [from Chris Schur](#) of Payson, Arizona; [from Robert B Slobins](#) of Talleyville, Delaware; [from Stan Richard](#) of Des Moines, Iowa; [from John Nordlie](#) of Fargo, North Dakota; [from Phil Harrington](#) of Brookhaven, NY; [from Freek van der Hulst](#) of the Netherlands; [from Jun Lao](#) of Deerfield Township, Ohio; [from Wayne Suns](#) of Tulsa, Oklahoma; [from John McClintock](#) of Johnsville, Ohio; [from Richard Bell](#) of Richland, Michigan.

SOLAR TSUNAMI: When sunspot 930 exploded on Dec. 6th, producing an X6-category flare, it also created a tsunami-like shock wave that rolled across the face of the sun, wiping out filaments and other

structures in its path. An [H-alpha](#) telescope in New Mexico operated by the National Solar Observatory (NSO) recorded the action:



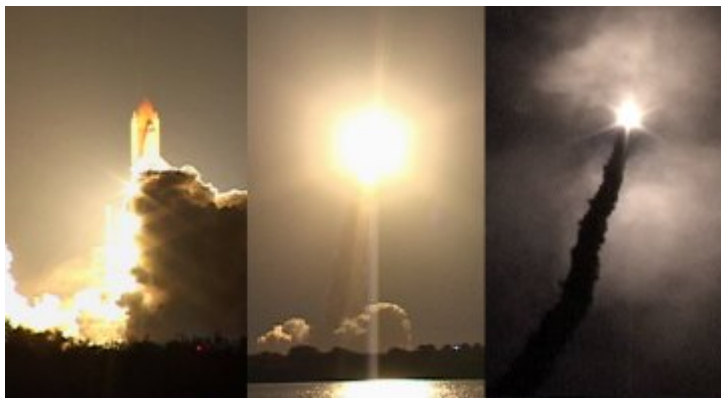
Credit: NSO/Optical Solar Patrol Network telescope

"These large scale blast waves occur infrequently, however, are very powerful," says Dr. K. S. Balasubramaniam of the National Solar Observatory. "They quickly propagate in a matter of minutes covering the whole sun and apparently sweeping away filamentary material." Researchers are unsure whether the filaments were blown off or were compressed so they were temporarily invisible. Get the [full story](#) from the NSO.

more images: [from Gary Palmer](#) of Los Angeles, California; [from Eric Roel](#) of Valle de Bravo, Mexico; [from Katy and John Stetson](#) of Falmouth, Maine; [from Greg Piepol](#) of Rockville, Maryland; [from Robert Morlan](#) of La Porte, Indiana; [from Paul Haese](#) of Adelaide, Australia.

What's Up in Space -- 10 Dec 2006

SUDDEN QUIET: After three days of intense storming last week, sunspot 930 has suddenly gone quiet. The sunspot's magnetic field has settled into a stable configuration and--for now--poses little threat for strong solar flares.



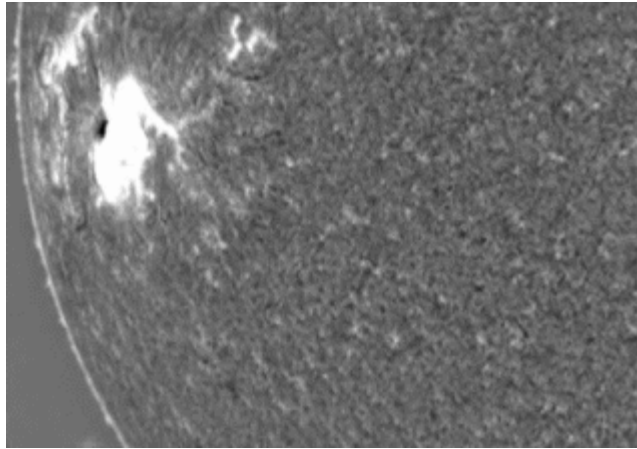
LIFTOFF! Space Shuttle Discovery and its crew of seven lifted off from the Kennedy Space Center last night at 8:47 pm EST. It was a spectacular after-dark launch, as shown in these images from photographer [Mike Theiss](#):

Expand: [#1](#), [#2](#), [#3](#). Credit: M. Theiss, [UltimateChase.com](#)

Turn up the volume. Theiss also recorded the sound of the shuttle's engines: [listen](#). "The crackling sound you hear is not a distortion. The launch really did sound like that," he says. "It was awesome."

The astronauts are now en route to the International Space Station. Their mission: to [re-wire the station](#). Changes are needed to take full advantage of two solar arrays installed in September. When they're done, there will be more [power to the ISS](#).

SOLAR TSUNAMI: When sunspot 930 exploded on Dec. 6th, producing an [X6](#)-category flare, it also created a tsunami-like shock wave that rolled across the face of the sun, wiping out filaments and other structures in its path. An [H-alpha](#) telescope in New Mexico operated by the National Solar Observatory (NSO) recorded the action:



Credit: NSO/Optical Solar Patrol Network telescope

"These large scale blast waves occur infrequently, however, are very powerful," says Dr. K. S. Balasubramaniam of the National Solar Observatory. "They quickly propagate in a matter of minutes covering the whole sun and apparently sweeping away filamentary material." Researchers are unsure whether the

filaments were blown off or were compressed so they were temporarily invisible. Get the [full story](#) from the NSO.



MORNING PLANETS: It's not easy, waking up early on a Sunday morning. Yesterday wasn't so bad. Early risers on Sunday, [Dec. 10th](#), saw a beautiful alignment of Mercury, Jupiter and Mars in the dawn sky:

"It was a great morning to see the planets," says photographer [William Biscorner](#) of Memphis, Michigan. "Clear and cold!"

more images: [from Rob Ratkowski](#) and Robert Zaleski at the Haleakala High Altitude Observatory in Maui; [from Wayne Wooten](#) of Pensacola, Florida; [from Brad Hoehne](#) of Columbus, Ohio; [from Brad Timerson](#) of Newark, New York; [from Vincent Jacques](#) near Menton, France; [from Philip Harrington](#) of Miller Place, New York; [from David Harvey](#) of Tucson, Arizona; [from Elizabeth Warner](#) of Alexandria, Virginia; [from Ginger Mayfield](#) of Divide, Colorado; [from Kevin Jung](#) near Grand Rapids, Michigan; [from Scott Manly](#) on the north bank of the Grand River in Ionia, Michigan; [from Jim Kurtz](#) of Kalamazoo, Michigan; [from Phil Yabut](#) of

Arlington, Virginia; [from Henk Brill](#) of Nieuwstadt, the Netherlands; [from Mike Hutchinson](#) of Muncie, Indiana; [from Denny Bodzash](#) of Henrietta, Ohio.

What's Up in Space -- 13 Dec 2006

METEOR SHOWER: The Geminid meteor shower peaks tonight. Start watching around 9 p.m. local time on Wednesday, Dec. 13th. The display will start small but grow in intensity as the night wears on. By Thursday morning, Dec. 14th, people in dark, rural areas could see one or two Geminids every minute. [[full story](#)] [[sky map](#)]

X-FLARE: Sunspot 930 has unleashed another big solar flare, an [X3](#)-class explosion at 0240 UT on Dec. 13th. In Huirangi, New Zealand, photographer [Andy Dodson](#) caught the spot in mid-flare:

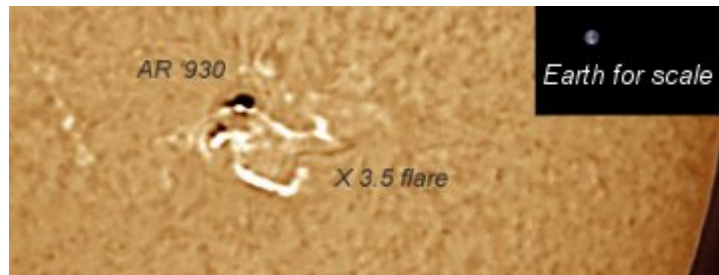


Photo details: Dec. 13, 2006, 0350 UT; Coronado [SolarMax40](#), Stellarvue 80.

As a result of the blast, a radiation storm is [underway](#). Based on the energy and number of solar protons streaming past Earth, NOAA ranks the storm as category [S2](#): satellites may experience some glitches and reboots, but astronauts are in no danger.



The explosion hurled a coronal mass ejection toward Earth: [movie](#). Sky watchers should be alert for [auroras](#) when it arrives on Dec. 14th. (Note: In [the movie](#), the CME is barely visible through a snowstorm of streaks and speckles. That "snow" is caused by solar protons peppering SOHO's digital camera.)

PASTEL SUN: "I've been watching sunspot 930 since it first appeared last week," says artist [Mark Seibold](#) of Troutdale, Oregon. Inspired by the view through his Coronado [SolarMax40](#), he made these pastel sketches:

Magnetic fields and hot plasma emerging from the sunspot's dark core reminded Seibold of "anatomical forms being born from a black pool. It conjures up William Herschel's assertion that 'the sun is richly stored with inhabitants.'"

Clearly, the sun's not just a star--it's a muse. Solar activity is surging, so grab your pastels.

BONUS: [STS-116 Night Launch Photo Gallery](#)

What's Up in Space -- 14 Dec 2006

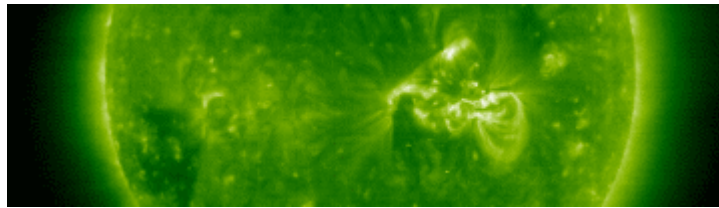
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Would you like a call when auroras appear over your hometown? Sign up for [Spaceweather PHONE](#).

GOOD GEMINIDS: The 2006 [Geminid meteor shower](#) peaked this morning, and the first reports are in: It was a good show. There were "lots of meteors and fireballs," says Alex Conu near Bucharest, Romania. One Geminid over Ozark, Arkansas, "produced shadows more intense than during a full moon!" reports Brian Emfinge: [gallery](#).

AURORA ALERT: Sky watchers, be alert for [auroras](#). A coronal mass ejection (CME) hit Earth today at approximately 1400 UT, and the impact may cause strong geomagnetic storms. Stay tuned for updates.

The CME was hurled toward Earth on Dec. 13th by an [X3](#)-class explosion from sunspot 930:



An X3-flare on Dec. 13th. Image credit: SOHO

NOAA forecasters estimate a 35% chance of more X-flares today. Sunspot 930 has an unstable "delta-class" magnetic field that could erupt at any moment.

What's Up in Space -- 15 Dec 2006

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SUBSIDING STORM: A geomagnetic storm that sparked Northern Lights as far south as Arizona last night is [subsiding](#). The cause of the storm: a coronal mass ejection (CME) hit Earth on Dec. 14th. Our planet's magnetic field reverberated for more than 24 hours after the impact.

Another CME is on the way, but it won't cause such a widespread display. The incoming cloud was launched yesterday by an X1-explosion above sunspot 930. The blast was not squarely Earth-directed, so the CME's impact will be a glancing one. Nevertheless, sky watchers should [remain alert](#) for auroras when the CME arrives on Dec. 16th.

What's Up in Space -- 16 Dec 2006

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SPECTACULAR AURORAS: What do [Alaska](#) and [Arizona](#) have in common? Northern Lights. Auroras appeared over both states on Dec. 14th when a coronal mass ejection (CME) hit Earth and sparked a severe geomagnetic storm: [gallery](#).

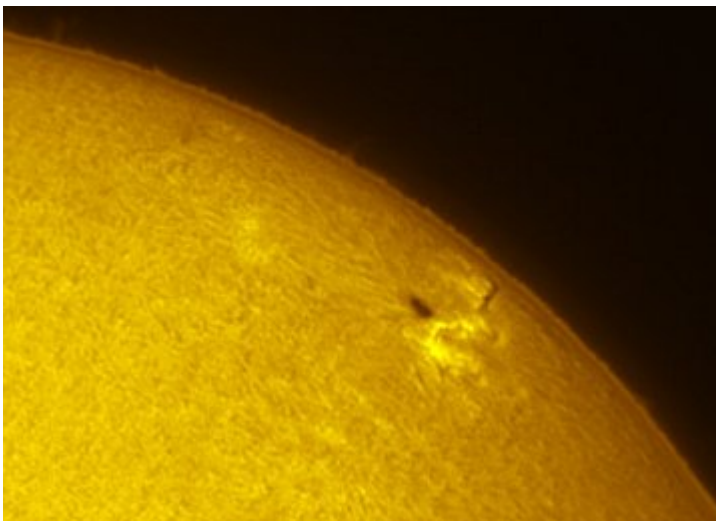
That storm has subsided, but another may be in the offing. NOAA forecasters estimate a 50% chance of severe geomagnetic activity on Dec. 16th when a second CME is expected to hit. Sky watchers should [remain alert](#) for auroras.



Above: Auroras over Saylorville Lake, Iowa, on Dec. 14th. "It was a beautiful display--lots of movement and pulsations, nice flowing curtains and some beautiful red beams," says photographer [Stan Richard](#). "The show lasted for one and a half hours."

[December 2006 Aurora Gallery](#)

Updated: December 16th



FAREWELL 930: The source of all this solar activity is sunspot 930. It won't be around much longer. The sun's rotation is carrying the active region toward the western limb, where it will vanish in a few days:

Above: [Sean Walker](#) of Chester, New Hampshire, used a [Coronado PST](#) to take this picture on Dec. 16th. It was nice to get "one last look at 930," says Walker. "There's also a beautiful forest of prominences on the other side of the sun: [image](#)."

more images: [from John Stetson](#) of Falmouth, Maine; [from John Nassr](#) of Baguio, Philippines; [from Peter Paice](#) of Belfast, Northern Ireland;

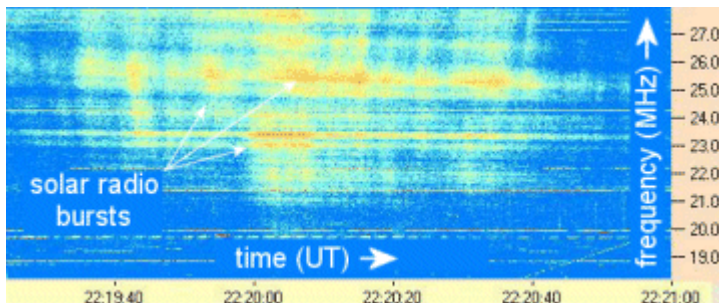


Above: Auroras over Kalamazoo, Michigan, on Dec. 14th. "We're so lucky!" says photographer [Richard Bell](#). "First, we get to observe the [Geminid meteor shower](#) on Wednesday then we get more Geminids and a nice aurora display on Thursday."

[December 2006 Aurora Gallery](#)

Updated: December 15th!

SOLAR RADIO BURSTS: The latest X-flare from sunspot 930 (an [X1.5](#) explosion at 22:15 UT on Dec. 14th) sent shock waves billowing through the sun's atmosphere. Those waves produced a cacophany of shortwave radio emissions. [Thomas Ashcraft](#) recorded some of them using his radio telescope in New Mexico: [listen](#).



Above: A spectrogram of solar radio bursts on Dec. 14th. Courtesy: NASA's Radio Jove Program and the University of Florida Radio Observatory ([UFRO](#)).

"We were lucky to catch a slice of these powerful solar radio sweeps at 22 MHz while the Sun was still in our antenna beams," says Ashcraft.

What's Up in Space -- 17 Dec 2006

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BEAUTIFUL FOREST: Readers, if you have a solar telescope, take a look at the eastern limb of the sun today. [Sean Walker](#) of Chester, New Hampshire, reports "a beautiful forest of prominences" there. He took [this picture](#) using his [Coronado PST](#).



THE STORM IS OVER: A coronal mass ejection hit Earth on Dec. 16th, but the glancing impact failed to re-energize geomagnetic activity. The severe magnetic storm of Dec. 14th is truly finished.

But you can still enjoy the auroras. [Our gallery](#) contains photos from Alaska to Arizona, and all points in between:

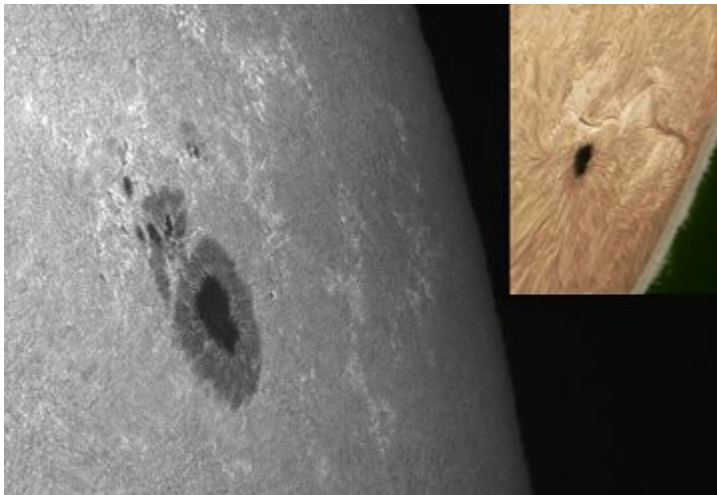
excellent display," says photographer [Chris VenHaus](#) of North Prairie, Wisconsin. "The partially frozen lake was a nice bonus."

Above: "Just after sunset on Dec. 14th, the auroras came out in full glory--a brief but

[December 2006 Aurora Gallery](#)

Updated: December 17th

GOODBYE... and thanks for the X-flares. Sunspot 930 announced itself on Dec. 5th with one of the [strongest flares](#) in years--an X9, followed by an X6 on Dec. 6th, an X3 on Dec. 13th and an X1 on Dec. 14th. Not bad for solar minimum!



Now the spot is departing. The sun's rotation is carrying it toward the western limb where it disappear from view in a day or so. [Rogerio Marcon](#) of Brasil took this picture on Dec. 16th:

Photo details: 150 mm refractor, Herschel Wedge, [SolarMax40](#).

As soon as sunspot 930 is out of sight, solar activity will return to low levels. Stay tuned for quiet.

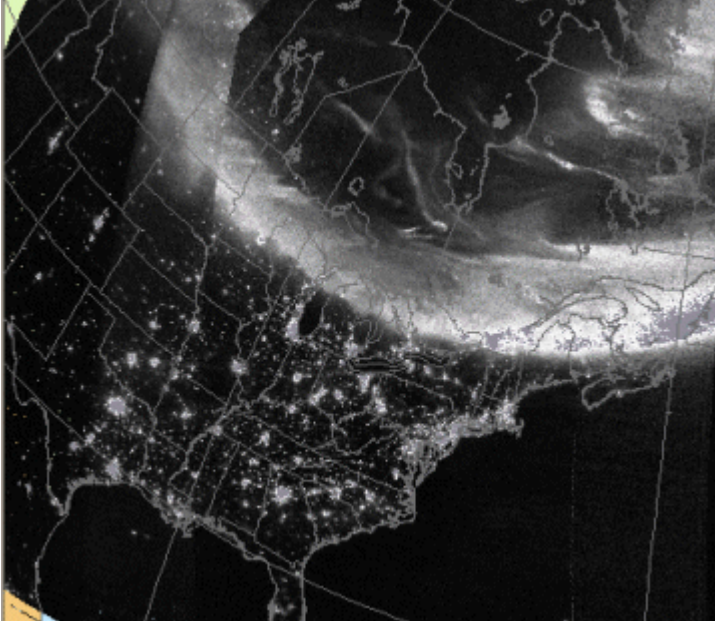
more images: [from John Stetson](#) of Falmouth, Maine; [from John Nassr](#) of Baguio, Philippines; [from Peter Paice](#) of Belfast, Northern Ireland;

[from Sean Walker](#) of Chester, New Hampshire.

What's Up in Space -- 18 Dec 2006

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URSID METEOR SHOWER: A flurry of meteors may emerge from Ursa Minor (the Little Dipper) on Dec. 22nd between 18 and 23 hours UT when Earth runs into a filament of debris trailing comet 8P/Tuttle. Meteor forecaster Peter Jenniskens of the SETI Institute anticipates as many as 39 meteors per hour, best seen from Europe and Asia. *Reference: IAU Electronic Telegram #773.*



AURORAS FROM SPACE: How bright were the auroras of Dec. 14th? As bright as city lights and easily seen from space. A US Air Force DMSP satellite took this picture from orbit 830 km above the United States:

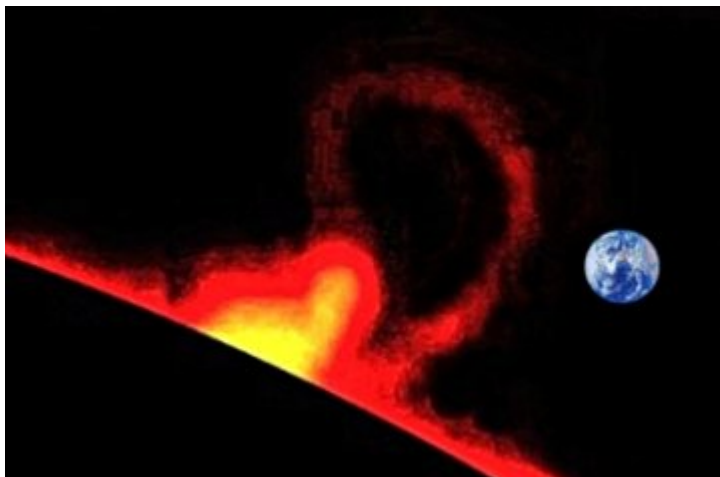
The bright arc stretching from Montana to Maine is the aurora borealis. In many places it completely overwhelms the city lights below.

"The DMSP satellite has the ability to detect auroral light at night," says [Paul McCrone](#) of the Air Force Weather Agency at Offutt AFB in Nebraska. "These images are mosaics of various DMSP overflights on [Dec. 12-13](#), [Dec. 13-14](#), and [Dec 14-15](#). The Dec. 14th image is quite striking."

[December 2006 Aurora Gallery](#)

Updated: December 18th

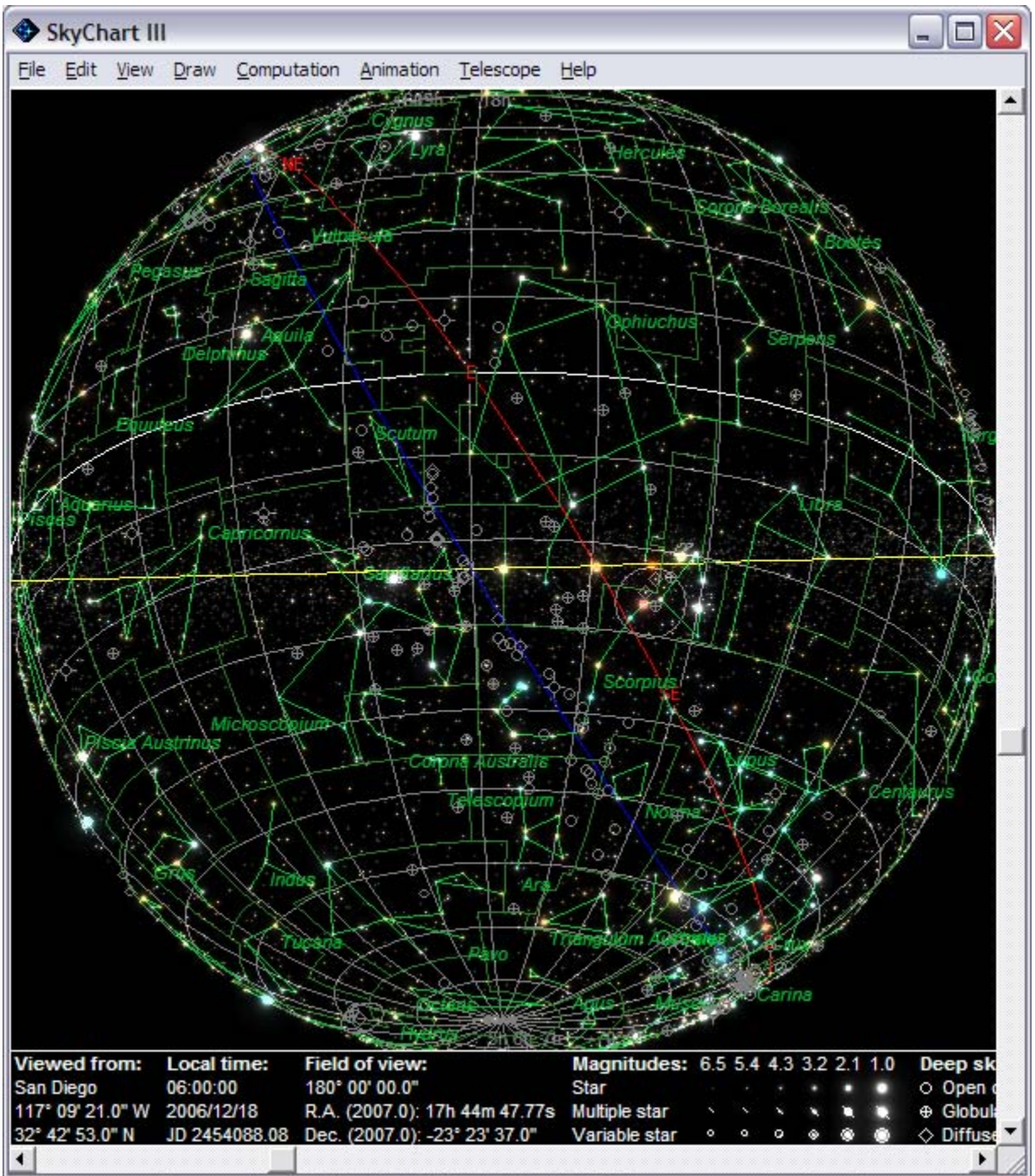
GOODBYE... and thanks for all the X-flares. Sunspot 930 announced itself on Dec. 5th with one of the [strongest flares](#) in years--an X9, followed by an X6 on Dec. 6th, an X3 on Dec. 13th, and an X1 on Dec. 14th. Not bad for solar minimum!



Now the spot is gone. The slow spin of the sun carried it over the sun's western limb this morning--but not before one last flare:

Photo details: [Coronado PST](#) and a [Canon XT1](#) digital camera.

"Today sunspot 930 said a nice goodbye," reports photographer [Mila Zinkova](#) of San Francisco, California. "There was [C2](#) flare at the limb with a nice ring-shaped prominence. The prominence changed shape and brightness constantly--very pretty."



Solar Flare Surprise

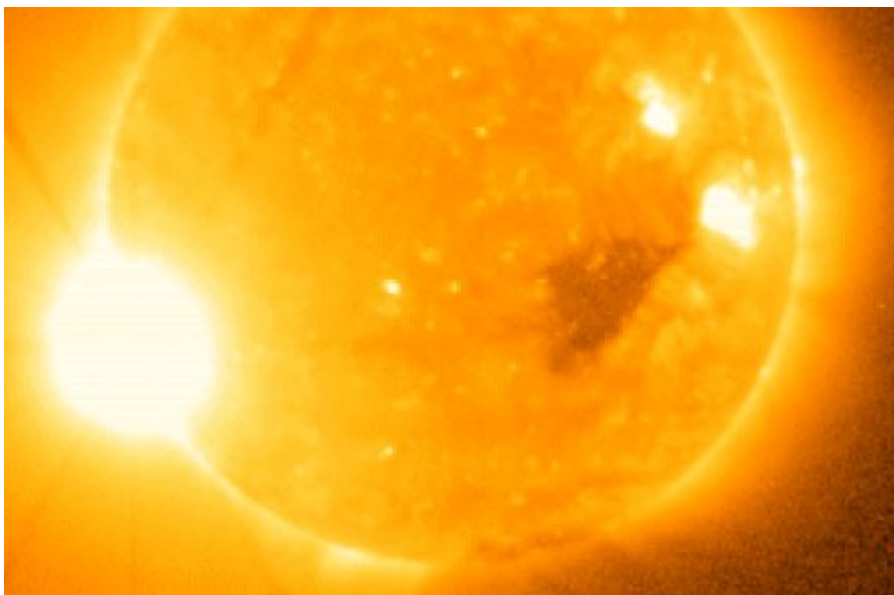
12.15.2008

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Dec. 15, 2008: Solar flares are the most powerful explosions in the solar system. Packing a punch equal to a hundred million hydrogen bombs, they obliterate everything in their immediate vicinity. Not a single atom should remain intact.

At least that's how it's supposed to work.

"We've detected a stream of perfectly intact hydrogen atoms shooting out of an X-class solar flare," says Richard Mewaldt of Caltech. "What a surprise! These atoms could be telling us something new about what happens inside flares."



Above: The X9-class solar flare of Dec. 5, 2006, observed by the Solar X-Ray Imager aboard NOAA's GOES-13 satellite. [[Larger image](#)]

The event occurred on Dec. 5, 2006. A large sunspot rounded the sun's eastern limb and with little warning it exploded. On the "Richter scale" of flares, which ranks X1 as a big event, the blast registered X9, making it one of the strongest flares of the past 30 years.

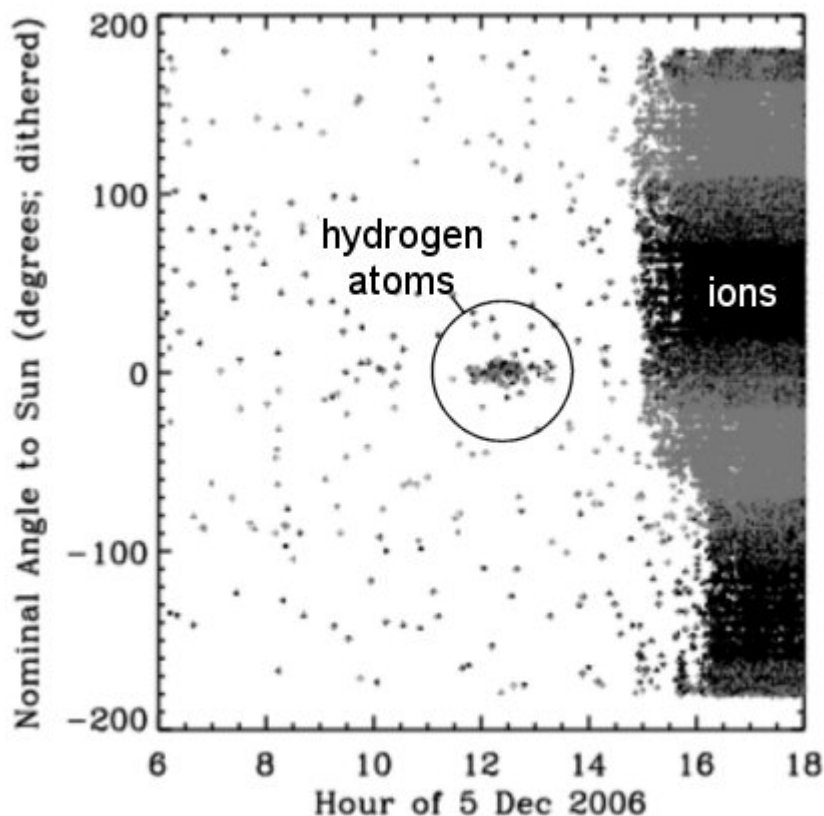
NASA managers braced themselves. Such a ferocious blast usually produces a blizzard of high-energy particles dangerous to both satellites and astronauts. Indeed, moments after the explosion, radio emissions from a shock wave in the sun's atmosphere signaled that a swarm of particles was on its way.

An hour later they arrived. But they were not the particles researchers expected.

NASA's twin STEREO spacecraft made the discovery: "It was a burst of hydrogen atoms," says Mewaldt. "No other elements were present, not even helium (the sun's second most abundant atomic species). Pure hydrogen streamed past the spacecraft for

a full 90 minutes."

Next came more than 30 minutes of quiet. The burst subsided and STEREO's particle counters returned to low levels. The event seemed to be over when a second wave of particles enveloped the spacecraft. These were the "broken atoms" that flares are supposed to produce—protons and heavier ions such as helium, oxygen and iron. "Better late than never," he says.



Above: STEREO particle counts on Dec. 5, 2006. The vertical axis measures the angle to the sun. Note how the initial hydrogen burst arrived from a narrow angle while the ions that followed swarmed in from all directions. The "swarming action" is a result of deflections by the sun's magnetic field--a force not felt by the neutral hydrogen.

At first, this unprecedented sequence of events baffled scientists, but now Mewaldt and colleagues believe they're getting to the bottom of the mystery.

First, how did the hydrogen atoms resist destruction?

"They didn't," says Mewaldt. "We believe they began their journey to Earth in pieces, as protons and electrons. Before they escaped the sun's atmosphere, however, some of the protons recaptured an electron, forming intact hydrogen atoms. The atoms left the sun in a fast, straight shot before they could be broken apart again." (For experts: The team believes the electrons were recaptured by some combination of radiative recombination and charge exchange.)

Second, what delayed the ions?

"Simple," says Mewaldt. "Ions are electrically charged and they feel the sun's magnetic field. Solar magnetism deflects ions and slows their progress to Earth. Hydrogen atoms, on the other hand, are electrically neutral. They can shoot straight out of the sun without magnetic interference."



Imagine two runners dashing for the finish line. One (the ion) is forced to run in a zig-zag pattern with zigs and zags as wide as the orbit of Mars. The other (the hydrogen atom) runs in a straight line. Who's going to win?

"The hydrogen atoms reached Earth two hours before the ions," says Mewaldt.

Mewaldt believes that all strong flares might emit hydrogen bursts, but they simply haven't been noticed before. He's looking forward to more X-flares now that the two STEREO spacecraft are widely separated on nearly opposite sides of the Sun. (In 2006 they were still together near Earth.) STEREO-A and -B may be able to triangulate future bursts and pinpoint the source of the hydrogen. This would allow the team to test their ideas about the surprising phenomenon.

"All we need now," he says, "is some solar activity."