

ABOVE THE FOG

• BULLETIN OF THE SAN FRANCISCO AMATEUR ASTRONOMERS •

Vol. 58, No. 8 – August 2010

Wednesday, August 18, 2010 – General Meeting

Randall Museum . 199 Museum Way . San Francisco

7:00 pm Doors Open

7:30 pm Announcements

8:00 pm Speaker

SFAA's General Meetings take place on the 3rd Wednesday of each month (except January)

NASA'S WIDE-FIELD INFRARED SURVEY EXPLORER

Dr. Bryan Mendez, UC Berkeley



NASA's Wide-field Infrared Survey Explorer (WISE) is mapping the sky in infrared light, searching for asteroids, the nearest and coolest stars, the origins of stellar and planetary systems, and the most luminous galaxies in the Universe. WISE is an unmanned satellite carrying an infrared-sensitive telescope that images the entire sky, providing a vast storehouse of knowledge about the Solar System, the Milky Way, and the Universe. During this lecture, I will describe the mission, its

history, current status, and some of the discoveries it has already made.

Bryan hails from Traverse City, Michigan where the dark sky enthralled him from a very early age and inspired him to study astronomy. He graduated from the University of Michigan in 1997 with degrees in Astronomy, Physics, and Saxophone Performance. Bryan continued his education at the University of California at Berkeley, where he researched the large scale flow of galaxies in the nearby Universe by measuring their distances. He received a Ph.D. in Astrophysics from UC Berkeley in 2002. Bryan now works at the Center for Science Education at UC Berkeley's Space Sciences Laboratory to educate and inspire others about the wonder and beauty of the Universe. His work in

space science education and public outreach involves developing programs for the public through the web and museums, developing classroom materials for students in K-12 classrooms, and conducting professional development for science educators.

IMPORTANT DATES

SFAA GENERAL MEETINGS & LECTURES

Randall Museum, 199 Museum Way (Near 14th Street and Roosevelt)

Third Wednesday of each month: 7:00 p.m. Doors open. 7:30 p.m. Announcements. 8:00 p.m. Speaker

SFAA BOARD MEETINGS IMMEDIATELY PRECEDE GENERAL MEETINGS AND BEGIN AT 6:00 P.M.

August 18
September 15
October 20

November 17
December 15

CITY STAR PARTIES *Land's End (Point Lobos)*

Map and directions: <http://www.sfaa-astronomy.org/clubarchive/directions-pointlobos.php>

August 21/7:30
September 18/7:30
October 16/6:30

November 13/5:00
December 11/5:00

TELESCOPE CLINIC ONE HOUR BEFORE SUNSET

NOTE: While City Star Parties WILL ALWAYS be held on Saturdays, some will be close to the last quarter phase of the moon; others will be close to first quarter. This is so we can work around dates for Mt. Tam public star parties as well as our Mt. Tam members-only events.

2010 MT TAM SPECIAL USE PERMIT STAR PARTIES - MEMBERS ONLY

GATEKEEPERS NEEDED

Special Use Permit observing nights on Mount Tamalpais are private and open only to SFAA members. Please arrive by sunset. A permit is required for each car. We must vacate the mountain by 2:00 a.m. except on specially approved nights (such as Messier Marathon).

August 7
September 4
October 2

November 6
December 4

MT TAM PUBLIC STAR PARTIES – TO BE ANNOUNCED

Public nights on Mount Tamalpais start with a lecture in the Mountain Theatre, followed by public viewing in the Rock Springs parking lot. SFAA members may view privately after crowd departs from approx. 11 pm-2 am.

AUGUST 14 - 8:30pm THE MANY MYSTERIES OF ANTIMATTER

Dr. Helen Quinn, SLAC-Stanford University

SEPTEMBER 11 - 8:30pm THE GLOBE AT NIGHT: HOW AND WHY TO PRESERVE THE NIGHT SKY

Kenneth Frank, Astronomical Society of the Pacific-Dark Sky Network

OCTOBER 9 - 8:00pm TERRAFORMING THE SECOND HOME FOR HUMANITY

Jim Brown, The Mars Society

For more information: <http://www.sfaa-astronomy.org/starparties/>

2010 San Francisco Amateur Astronomers Lecture Series

Free & Open to the Public

sfaa-astronomy.org

Randall Museum
199 Museum Way
San Francisco
Randall Museum Theater
randallmuseum.org
7:30 p.m.

September 15th

Chris McKay, NASA Ames

“Hot and Cold Extreme Environments”. This talk centers on astrobiologist Chris McKay’s travels and his research to learn about possible life in our Solar System.

October 20th

Jennifer L. Heldmann, NASA Ames

Lunar Impact: NASA’s LCross Mission

Dr. Heldman served on the Science Team, Payload Team, and as the Observation Campaign Coordinator for NASA’s Lunar Crater Observation and Sensing Satellite (LCROSS) mission to study the permanently shadowed regions of the lunar poles. The science goals of LCROSS included investigating the presence or absence of water on the Moon as well as furthering our understanding of other species trapped in these regions.

November 17th

Lynn Cominsky, NASA Fermi & Sonoma State Astrophysics Dept.

Dr. Cominsky has been analyzing data on high energy physics and neutron star binaries from X-ray satellites for over 25 years. She will share the most recent discoveries.

Dec. 15th

John Dillon, past president of San Francisco Amateur Astronomers

John will continue with another of his insightful talks on the history of science, especially as it relates to astronomical knowledge

2010 GENERAL MEETING SNACKS SIGN-UP LIST

San Francisco Amateur Astronomers list for volunteers to bring snacks before the lectures at the Randall Museum. Plan to arrive to set up by 7:00pm.

Plan to bring “munchie” snacks and soft drinks. The Randall supplies a coffee pot to make hot water, instant coffee & tea bags, and paper supplies.

You may request reimbursement or donate your items to SFAA with thanks.

Date	Name	E-mail	Phone #
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August 18 _____

September 15 _____

October 20 _____

November 17 _____

December 15 _____

You will be contacted to confirm the month you've volunteered to bring snacks.

Thank you.

August 2010 Almanac for San Francisco (Pacific Daylight Time)

(Source: US Naval Observatory)

Sun and Moon Data:

Date	Astronomical Twilight Begins	Sunrise	Sunset	Astronomical Twilight Ends	Moon	Moonrise	Moonset
7 Aug	4:38 am	6:19 am	8:12 pm	9:52 pm		3:21 am	6:27 pm
14 Aug	4:47 am	6:25 am	8:04 pm	9:41 pm		11:58 am	10:36 pm
21 Aug	4:55 am	6:31 am	7:54 pm	9:29 pm		6:16 pm	3:40 am
28 Aug	5:03 am	6:37 am	7:44 pm	9:17 pm		9:21 pm	10:24 am

Planetary Data:

	Mercury		Venus		Mars		Jupiter	
								
	Leo (1-4, 7-30) / Sex (5-6, 31)		Virgo		Virgo		Pisces	
Date	Rise	Set	Rise	Set	Rise	Set	Rise	Set
7 Aug	8:38 am	9:16 pm	10:06 am	10:07 pm	10:28 am	10:22 pm	10:14 pm	10:21 am
14 Aug	8:37 am	8:55 pm	10:14 am	9:53 pm	10:22 am	10:04 pm	9:46 pm	9:52 am
21 Aug	8:19 am	8:26 pm	10:21 am	9:39 pm	10:17 am	9:48 pm	9:17 pm	9:21 am
28 Aug	7:38 am	7:49 pm	10:26 am	9:24 pm	10:11 am	9:31 pm	8:48 pm	8:50 am

	Saturn		Uranus		Neptune	
						
	Virgo		Pisces		Aquarius	
Date	Rise	Set	Rise	Set	Rise	Set
7 Aug	10:07 am	10:20 pm	10:04 pm	10:08 am	8:41 pm	7:28 am
14 Aug	9:43 am	9:54 pm	9:36 pm	9:40 am	8:13 pm	7:00 am
21 Aug	9:19 am	9:28 pm	9:08 pm	9:11 am	7:45 pm	6:31 am
28 Aug	8:55 am	9:02 pm	8:40 pm	8:42 am	7:17 pm	6:03 am

August Phenomena:

8 Aug, 10:00 am: Venus 2.7° S of Saturn
 10 Aug, 3:00 pm: Regulus 4.3° N of Moon
 11 Aug, 4:00 pm: Mercury 2.1° N of Moon
 12-13 Aug: Perseids meteor shower
 13 Aug, 2:00 am: Venus 4.1° N of Moon
 13 Aug, 6:00 am: Mars 5.4° N of Moon
 14 Aug, 7:00 am: Spica 3.0° N of Moon

17 Aug, 4:00 pm: Antares 1.9° S of Moon
 19 Aug, 1:00 pm: Pluto 5.6° N of Moon
 19 Aug, 7:00 pm: Mercury stationary
 20 Aug, 3:00 am: Neptune at opposition
 20 Aug, 2:00 pm: Venus 2.0° S of Mars
 26 Aug, 7:00 pm: Uranus 5.8° S of Moon
 31 Aug, 11:00 pm: Venus 1.0° S of Spica

MT TAMALPAIS STATE PARK
MT. TAMALPAIS INTERPRETIVE ASSOCIATION
2010 ASTRONOMY PROGRAMS
our 22nd season on the Mountain

AUGUST 14 8:30pm

THE MANY MYSTERIES OF ANTIMATTER

How and when the imbalance of matter over antimatter developed is one of the great mysteries to unravel to understand the underlying properties of the universe. Dr. Helen Quinn, SLAC-Stanford University

As always the program is FREE and open to the general public. Weather permitting it will be followed by telescope viewing in the Rock Springs parking lot with the San Francisco Amateur Astronomers. Dress appropriately (June was cold!) and bring a flashlight. Please car pool if possible. If the weather is questionable you can check the hotline 415-455-5370 after 3:00pm which is updated IF there is a change.

Some of you "old timers" may remember Steve Moore, who helped with our programs a few years back. He writes that he is now with the National Park Service at Great Basin National Park this summer as an Interpretive Park Ranger. Great Basin is in the far eastern side of Nevada, and is rated as one of the top National Parks for dark skies. The park is hosting its first annual Astronomy Festival on August 6 - 8. It will essentially be a weekend star party, with guest speakers and activities. More information is obtainable from the Park's website. Should any of you go to this event say hi to Steve, and we will welcome a report at our Aug 14 program.

SEPTEMBER 11 8: 30pm

THE GLOBE AT NIGHT: HOW AND WHY TO PRESERVE THE NIGHT SKY

Saving our Dark Skies is a Global Problem. Find out how light pollution is measured and what you can do to understand and help preserve this natural resource locally. Kenneth Frank, Astronomical Society of the Pacific-Dark Sky Network

OCTOBER 9 8:00pm

TERRAFORMING THE SECOND HOME FOR HUMANITY

The ultimate development of a planet as a second home for Earth life is terraforming. Why is Mars the most productive next place to settle and how can it be terraformed. Jim Brown, The Mars Society



pan shot courtesy of Mojo

SFAA Yosemite Star Party at Glacier Point Friday, August 20 & Saturday, August 21, 2010

NEW! Check out last year's [photos](#), thanks to Dave Frey and Dean Gustafson

For those of you unfamiliar with this event, we are given free, reserved admission to Yosemite National Park and shared camping space at Bridalveil Group Campground. The campsite is 8.5 miles away from Glacier Point. In exchange, we give two public star parties at Glacier Point, on Friday and Saturday night. We have the public (about 200 - 300 people) from twilight for a few hours, and then the rest of the night (and all day) to ourselves; this is a mighty good deal, considering how some folks come 12,000 miles to see these rocks. The National Park Service limits astronomy clubs to a maximum of 30 SFAA campers. Please do not ask if your friends can come ... unless they are SFAA members.

Want to [join](#) the SFAA? This is our biggest membership magnet; come join the SFAA! You are expected to have at least one public telescope for every two people. Sign up with [Dave Frey](#) our fearless president. Please title the e-mail Yosemite Sign-Up, let him know what telescope you're bringing and if you're solo or not. We currently have zero members on the wait list. Please let Dave know right away, so that we have an accurate count, and you don't miss out on this very special event! Here is who is on the [sign-up roster](#) as of Saturday, May 22nd. In case you have questions, thanks to [Jim Van Nuland](#) of the SJAA here's a [link](#) San Jose club members have.

Bear Alert- *Please remember we are guests at Yosemite and among those who live there are [bears](#). Last weekend one of our intrepid Sidewalk Astronomers and SFAA members (Dean Gustafson) spent time with the Santa Cruz Club at Glacier Point. Dean wants us to know that a bear with a yellow tag of # 47 helped himself to a bag of food behind the back of an SCAS member at Glacier Point while observing! Please keep all food (including gum, toothpaste, canned food, you-name-it) in the metal bear boxes and not in your car, tent or now unfortunately, while observing.*

Observing site at Glacier Point- The observing area is mostly open, with incredible views from about NNW to the east, around to due south. The horizon from south around to the west is partly blocked by tall trees. Still, there is a lot of open sky, and typically, the seeing and transparency are excellent. It has warm temperatures of 70 to 90 during the day, and cool to chilly 40's at night, due to the elevation of 7200 feet.

Star Party- One of the rangers does a sunset talk, and then delivers the crowd to us. Following that, a member of the club will give an evening talk, (want to volunteer?) The public will have white flashlights, and we need to be tolerant of that. We will have 3 club members with red brake light tape to politely cover the offending flashlights. Expect many questions from the public. Here is an [object list](#) with corresponding finder charts and some brief information.

The Reward- By around 9:30 or so, we will have the place to ourselves, and can stay until dawn if you so choose. Scopes must be removed when we quit, then set up again on Saturday. Some of us may set up sun scopes during the afternoon, show Half Dome festooned with rock climbers, and invite people to come again after sunset.

Gastronomic Astronomic- Early Saturday eve is the traditional potluck meal and is always [tons of fun](#). Please provide enough for ~ say 4 or 5 people. Salads, main courses, pu pu's and desserts are all welcome. Who will have the best astronomical theme of incredible edibles this year? Remember the Brown Dwarfs? Prizes will be awarded! Please remember this repast takes time. It's better to start our own gastronomic party early so there's no need to rush for set up Saturday evening on Glacier Point. Sunset Friday will be at 8:25 pm.

Check the [National Weather Service](#) for up-to-date weather info on Yosemite Park current weather and conditions. Here is a live cam of Half Dome from [Ahwahnee Meadow](#) and [NPS Air Quality Cam & data](#).

For newbies and oldsters alike please review the [directions and guidelines](#). See you at the campsite,

Ken & Dave
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October 8-9, 2010
Annual SFAA NIGHT - Fremont Peak Observatory



Photo courtesy of ART ROSCH
Some previous years photos:
[05](#) [06](#) [07](#) [08](#) [09](#)

Each year for the past few years the FPOA has graciously granted us use of their 30-inch telescope for a Friday. In exchange, we do a public program the following day and night as a thank you. We have reserved the Observatory Friday, October 8th evening for an exclusive private gathering of members from the SFAA.

Wanna come? It's open to all current dues paying [members](#) of SFAA. Please [email](#) all the following information: your license plate #, type and color of your car, if you are Friday Only in attendance and if you're bringing a scope the type and size like you do for Yosemite.

[Here's](#) who has signed up.

The Fremont Peak Observatory features a fine [30-inch f/4.8 Newtonian telescope](#) built by Kevin Medlock of the [Eastbay Astronomical Society](#). The telescope is mounted on an English cross-axis equatorial system. There are also 6 powered observing pads outside the observatory, where visiting astronomers (like SFAAer [Richard Crisp](#)) can set up to observe in Fremont Peak's dark skies.

From [March through October](#), Fremont Peak Observatory conducts programs for the public at least three Saturday evenings a month, excluding the Saturday closest to full moon.

[Fremont Peak State Park](#) is about 100 miles south of San Francisco, and eleven miles south east of the town of San Juan Bautista. The park features camping facilities which are available either by [reservation](#) or first come first served basis. Please be sure and pay the day or or if camping the overnight fee in the green box by the public phone. At the bottom of the hill in San Juan Bautista is the [San Juan Inn](#) for those who would like more civilized overnight amenities.

Doug Brown, President of FPOA, noted that Fremont Peak has long been popular as a nearby dark sky observing and astrophotography site with a excellent southern horizons, and is even mentioned as a stopping place on page 50 of the May-June 2005 issue of AAA's Via Magazine! If you're interested, contact [Doug](#).

Dr. Doris Sloan, an FPOA member wrote an article in Bay Nature Magazine about Fremont Peak. Coincidentally the [April-June 08 article](#) is embellished with our own Michael Kran's photos as well!

For SFAA members wanting to enjoy this gorgeous telescope on their own, practically whenever they choose (with a few exceptions) and you're interested in joining FPOA Those interested in joining FPOA can learn about the benefits of membership and [download an application form](#).

Also, if you'd like to participate in a great social activity with the FPOA folks, they are having their Star B Q in conjunction with the [AANC](#) on Saturday July 17th. However, please do let [Doug Brown](#) know if you're interested in coming.. The Fremont Peak Star B Q is always fun and sure to please.

For more information about Fremont Peak Observatory, including excellent directions to Fremont Peak State Park and the Observatory, visit their web site at <http://www.fpoa.net>

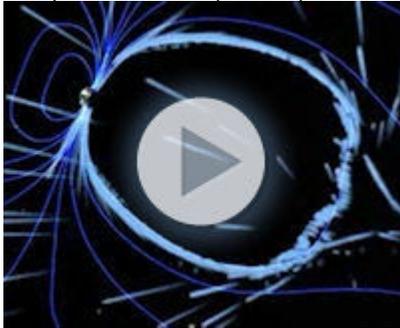
Looking forward to seeing you again this year,

Ken

SPACEQUAKES RUMBLE NEAR EARTH

*Rumbles without sound
Auroras rain down
Magnetic fields shake
Beware the spacequake*

July 27, 2010: Researchers using NASA's fleet of five THEMIS spacecraft have discovered a form of space weather that packs the punch of an earthquake and plays a key role in sparking bright Northern Lights. They call it "the spacequake."



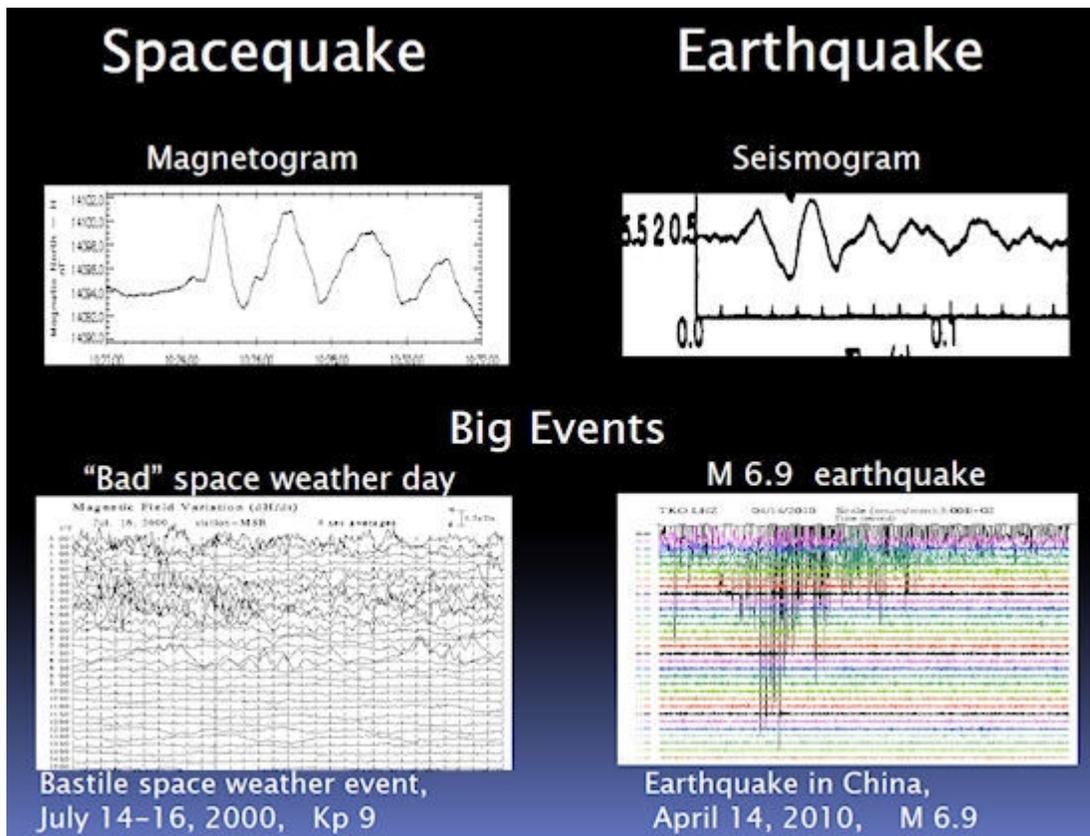
A spacequake in action. [Click](#) to launch a computer-simulated movie created by Walt Feimer of Goddard's Scientific Visualization Lab.

A spacequake is a temblor in Earth's magnetic field. It is felt most strongly in Earth orbit, but is not exclusive to space. The effects can reach all the way down to the surface of Earth itself.

"Magnetic reverberations have been detected at ground stations all around the globe, much like seismic detectors measure a large earthquake," says THEMIS principal investigator Vassilis Angelopoulos of UCLA.

It's an apt analogy because "the total energy in a spacequake can rival that of a magnitude 5 or 6 earthquake," according to Evgeny Panov of the Space Research Institute in Austria. Panov is first author of a paper reporting the results in the April 2010 issue of *Geophysical Research Letters* (GRL).

In 2007, THEMIS discovered the precursors of spacequakes. The action begins in Earth's magnetic tail, which is stretched out like a windsock by the million mph solar wind. Sometimes the tail can become so stretched and tension-filled, it snaps back like an over-torqued rubber band. Solar wind plasma trapped



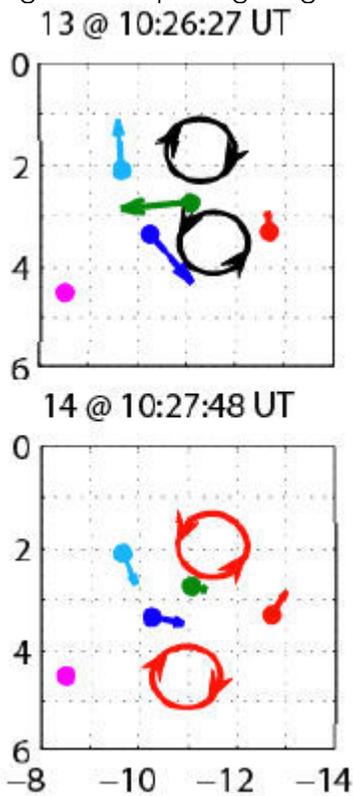
in the tail hurtles toward Earth. On more than one occasion, the five THEMIS spacecraft were in the line of fire when these "plasma jets" swept by. Clearly, the jets were going to hit Earth. But what would happen then? The fleet moved closer to the planet to find out. "Now we know," says THEMIS project scientist David Sibeck of the Goddard Space Flight Center. "Plasma jets trigger spacequakes."

During a spacequake, Earth's magnetic field shakes in a way that is analogous to the shaking of the ground during an earthquake. Image credit: Evgeny Panov, Space Research Institute of Austria. [\[larger image\]](#)

According to THEMIS, the jets crash into the geomagnetic field some 30,000 km above Earth's equator. The impact sets off a rebounding process, in which the incoming plasma actually bounces up and down on the reverberating magnetic field. Researchers call it "repetitive flow rebuffering." It's akin to a tennis ball bouncing up and down on a carpeted floor. The first bounce is a big one, followed by bounces of decreasing amplitude as energy is dissipated in the carpet.

"We've long suspected that something like this was happening," says Sibeck. "By observing the process in situ, however, THEMIS has discovered something new and surprising."

The surprise is plasma vortices, huge whirls of magnetized gas as wide as Earth itself, spinning on the verge of the quaking magnetic field.



A THEMIS map of plasma flows during a spacequake. The axes are labeled in Earth radii, so each swirl is about the size of Earth. [\[larger image\]](#)

"When plasma jets hit the inner magnetosphere, vortices with opposite sense of rotation appear and reappear on either side of the plasma jet," explains Rumi Nakamura of the Space Research Institute in Austria, a co-author of the study. "We believe the vortices can generate substantial electrical currents in the near-Earth environment."

Acting together, vortices and spacequakes could have a noticeable effect on Earth. The tails of vortices may funnel particles into Earth's atmosphere, sparking auroras and making waves of ionization that disturb radio communications and GPS. By tugging on surface magnetic fields, spacequakes generate currents in the very ground we walk on. Ground current surges can have profound consequences, in extreme cases bringing down power grids over a wide area.

After THEMIS discovered the jets and quakes, Joachim Birn of the Los Alamos National Lab in New Mexico conducted a computer simulation of the rebounding process. Lo and behold, vortices appeared in good accord with THEMIS measurements. Moreover, the simulations suggest that the rebounding process can be seen from Earth's surface in the form of ripples and whirls in auroral displays. Ground stations report just

such a phenomenon.

"It's a complicated process, but it all fits together," says Sibeck.

The work isn't finished. "We still have a lot to learn," he adds. "How big can spacequakes become? How many vortices can swirl around Earth at once--and how do they interact with one another?"

Stay tuned for answers from THEMIS.

*Vortices swirl
plasma a'twirl
Richter predicts
a magnitude six*

2010 Club Officers & Contacts

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Club Telescopes

The SFAA owns eight very fine, easy to use, loaner telescopes well-suited for deep sky, planets, and star parties. All scopes are available to any SFAA member. The loaner custodians for the majority of our fleet are Pete & Sarah Goldie. Please contact them at telescopes@sfaa-astronomy.org for details if you are interested in borrowing a scope or if you have items you can donate for the loaner program (eyepieces, star maps/books, red flashlights, collimator, etc.). Please contact the appropriate member indicated below if you are interested in borrowing one of the telescopes.

- 1) 6" f/10.3 Dobsonian/Ken Frank ken@sfaa-astronomy.org
- 2) 8" f/7 Dobsonian/Pete Goldie
- 3) 8.5" f/6 Dobsonian/Pete Goldie
- 4) 10" f/8 Dobsonian/Pete Goldie
- 5) 114mm f/4 Newtonian StarBlast/Pete Goldie
- 6) 8" f/10 Celestron SCT/Annette Gabrielli/ annette@sfaa-astronomy.org
- 7) 8" f/10 Meade SCT/Stefanie Ulrey/treasurer@sfaa-astronomy.org
- 8) 9.5" f/5.6 Celestron Newtonian/Ken Frank/ ken@sfaa-astronomy.org

Club Astronomy Videos

The SFAA owns a series of astronomy videotapes featuring Alex Filippenko, a world-renowned professor of astronomy at UC Berkeley. The videotapes provide an introduction to astronomy and cover topics such as the Solar System, the lifecycles of stars, the nature of galaxies, and the birth of the Universe. The SFAA loans the tapes free to all members. If you are interested in viewing these tapes, you may check them out at any of the SFAA General Meetings. These tapes were kindly donated to the SFAA by Bert Katzung. For information on the course tapes themselves:

<http://www.teach12.com/tlc/assets/coursedescriptions/180.asp>

Membership Dues

Membership is billed for each upcoming year on June 30. Members may receive no more than one bulletin after the expiration of membership.

SFAA Website and Online Services

The SFAA web site at sfaa-astronomy.org is provided to our members and the general public for the sharing of club information and services. The web site contains links for club [star parties](#), [events](#), [newsletters](#), [lectures](#) and [meetings](#). If you wish to interact with other people who are interested in astronomy, the SFAA web site offers public and members only [bulletin board forums](#). If you wish to remain up-to-date on club activities, then we encourage you to subscribe to one or both of our public [mailing lists](#), which will allow you to receive our newsletter and/or club announcements via email. Other useful and interesting information and services are available on the site such as [observing location reviews](#), member [astronomy photos](#), and [members only telescope loans](#). Information about SFAA's membership, organization and by-laws are available at the club's online public document [archive](#). If you need to contact a representative of the SFAA, then please visit our [contacts](#) page to help in finding the right person to answer your questions.

Above the Fog is the official bulletin of the San Francisco Amateur Astronomers. It is the forum in which club members may share their experiences, ideas, and observations. We encourage you to participate by submitting your articles, announcements, letters, photos and drawings. We would also like to hear from our new members. Tell us about yourself – what you have done in the past and what other clubs you have joined. **The deadline for the next issue is the 25th day of the month.** Send your articles to Editor@sfaa-astronomy.org

San Francisco Amateur Astronomers
PO B 15097
San Francisco CA 94115

Please make checks payable to San Francisco Amateur Astronomers and mail to:

_____ E-Mail
_____ Hard Copy

You can choose E-Mail (Recommended) or hard copy delivery for Above the Fog (Check one)

Information: Name(s) _____
 Address _____
 City _____
 State _____
 Home Phone _____
 E-Mail _____

 _____ Zip _____

Membership Categories (Check one): _____
 \$10 Youth/Student _____
 \$25 Individual _____
 \$30 Family _____
 \$40 Institutional _____
 \$75 Supporting _____

Members pay one half for each upcoming year on June 30. Between January 1 and June 30, new members pay one half the amount listed below

MEMBERSHIP APPLICATION

San Francisco Amateur Astronomers
 P.O. Box 15097
 San Francisco, CA 94115



Information Hotline: (415) 289-6636

Web Page: www.sfaa-astronomy.org

Sharing the Wonders of the Universe

Has your membership expired? Your mailing label includes the month and year through which your membership is paid. If it is past, your membership has expired and this may be your last issue.