



the Webfooted Astronomer

News from the Seattle Astronomical Society

December 2008

Hubble: Past and Future

by Greg Scheiderer

University of Washington astronomy professor Bruce Balick has been actively involved in the design of a hot new instrument that will be going up in the next, and final, space shuttle servicing mission to the Hubble Space Telescope. The Wide Field Camera 3 (WFC3) will help Hubble break new ground.

Balick waxed poetic about the telescope during his talk at the November meeting of the Seattle Astronomical Society. He noted that 2009 marks not only the 20th anniversary of Hubble in space, but also the 400th year since Galileo used a telescope for astronomy. In Balick's view, Galileo's observations of the phases of Venus, demonstrating that the Sun is at the center of the Solar System, changed science forever.

"The fight that ensued sprang science loose from the grips of the Vatican," he said. "It was the rebirth of empirical science: watch the universe, listen to the way it behaves, and construct your beliefs around evidence. That was the really momentous occasion in Galileo's life. That's the legacy that he leaves us today."

Balick looks back with fondness on Hubble's first two decades.

"It's been a phenomenal instrument," he said, adding, "It has upended my field of research."

His field is planetary nebulae, and he spoke of being at a conference in 1993 and being confident that they had the subject all figured out. "The first pictures of a planetary nebula to come down from Hubble arrived at the very end of that meeting," he recalled, "and we knew that we had a long future ahead of us."

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NEXT MEETING

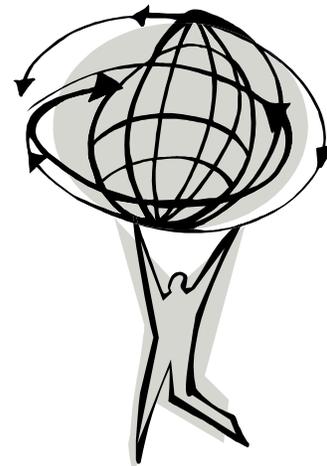
December 17 — 7:30 p.m.
University of Washington
Physics/Astronomy Building,
Room A-102

Get your constellation groove on!

So, you think you know your constellations? Prove it! At our December meeting Maxine Nagel will present her flashcard-based "constellation quiz."

No fair blurting out all of the answers!

Bring the entire family. The quiz is appropriate for kids and adults alike.



SAS Calendar

December 10 — just before 11 p.m.
Nearly full Moon occults the Pleiades

December 13 — 6:30 p.m.
Amateur telescope makers SIG meeting
Contact: atm@seattleastro.org

December 13-14
Geminid meteor shower peaks this evening.
A full Moon will somewhat spoil the show.

December 17 — 7:30 p.m.
Seattle Astronomical Society Meeting
Guest speaker: Maxine Nagel, constellation
quiz. Details on page 1.

December 27 — 6 p.m.
Tiger Mountain Star Party (members only)

December 27 — New Moon

December 28-31
Mercury, Jupiter and the Moon dance
together on the 28th and 29th; the Moon
makes a pass at Venus on New Year's Eve

January 3 — First quarter Moon

January 3 — 7 p.m.
Seattle Astronomical Society Star Parties

- ◆ Green Lake, Seattle
- ◆ Paramount Park, Shoreline

January 11
Annual SAS banquet, Rock Salt Restaurant
Guest speaker: Author Dava Sobel!

SAS officers

President, Karl Schroeder
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VP Education, Mohammad Sarwat
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SAS and the International Year of Astronomy



From the president's desk
By Karl Schroeder

Greetings from your new SAS president!

Many of you already know me, from my years in the club and previous service to the club as co-editor of the newsletter, holder of several elected offices and convener of the new astronomer seminars held at my home.

In 2004, I earned a master's degree in astronomy from Swinburne University. Since then I have taught astronomy for Trinity Lutheran College and Columbia College. As you might guess, I'm passionate about astronomy.

Since 2009 is the International Year of Astronomy, my goal for the club is participating in as many related activities as we can – offering club support to UW Astronomy Department events, Astronomy Day at the Pacific Science Center, expanding club star parties and getting people involved with astronomy in as many different ways as possible.

Whatever part of astronomy is your favorite, we'll try to give you an opportunity to share your enthusiasm with other folks – in the club and out in the community.

Keep looking at the stars!

Save the date! SAS banquet set for Jan. 11; author Dava Sobel will be guest speaker

Author Dava Sobel will be the guest speaker at the annual Seattle Astronomical Society Banquet, scheduled for Sunday, Jan. 11, at the Rock Salt Restaurant on Westlake Avenue next to Lake Union.

Sobel, a former *New York Times* science reporter, is the author of *Longitude* (Walker 1995 and 2005, Penguin 1996), *Galileo's Daughter* (Walker 1999, Penguin 2000) and *The Planets* (Viking 2005, Penguin 2006).

In her thirty years as a science journalist she has written for many magazines, including *Audubon*, *Discover*, *Life* and *The New Yorker*, served as a contributing editor to *Harvard Magazine* and *Omni*, and co-authored five books, including *Is Anyone Out There?* with astronomer Frank Drake. By coincidence, Drake was mentioned in our recent discussion of Fermi's Paradox (WFA, [November, 2008](#).)



Dava Sobel. Photo by Paul Schneck.

Read more about Dava Sobel at her Web site, www.davasobel.com.

Doors will open at 5:30, and dinner will be served at 6:15. Steak, fish, and vegetarian entrees are available. Cost per person is \$35. You can sign up and pay now on-line or download a registration form at www.seattleastro.org/banquet.shtml. Make a menu selection when registering on-line or it won't process.

SAS elects new slate of officers

The Seattle Astronomical Society elected a new slate of officers at its annual meeting Nov. 19. The new officers are:

Karl Schroeder, President
Jon Bearscove, Board Chair
Jerry Kuch, Vice President, Activities
Mohammad Sarwat, VP, Education
Rod Ash, VP, Membership
Judy Schroeder, VP, Publicity
Connie Griffith, Secretary
Maxine Nagel, Treasurer

Kuch and Sarwat are new to the board, as are the Schroeders, though both have served SAS in a variety of positions over the years.

The election was hard-fought and contentious, as it always is. You will recall that as of the publication of the November issue of *The Webfooted Astronomer*, candidates had not been identified for president or VP publicity. Karl and Judy Schroeder volunteered to run just as that issue was going out. The slate was accepted with only one dissenting vote, the traditional “nay” from Uncle Bob Suryan.

Karl Schroeder gave a lengthy acceptance speech: “I’m back,” he said.

Thanks go to out-going president Jon Bearscove for two outstanding years at the helm, as well as to departing board members Mike Langley, Thomas Vaughan, and Greg Scheiderer, and to trustees Denis Janky and Kari Christensen.

A sad farewell to SAS member Pat Lewis

Longtime Seattle Astronomical Society member Pat Lewis passed away Nov. 19 at the age of 89. A memorial service was held Dec. 3 at University Presbyterian Church in Seattle.

Lewis suffered a broken hip in a fall Oct. 31. Surgery on her hip exacerbated problems with her heart and lungs, and she was unable to recover. Joanne Green reported that Pat died peacefully; she was in good spirits and “eager to go to her Lord Jesus.”

Readers of *The Webfooted Astronomer* have Pat and Joanne to thank. They’ve been our “circulation department” for a number of years, handling the printing and mailing of the hard copies of this newsletter.

Billy Krueter writes that, “Pat, along with Joanne, gave wondrously detailed presentations about equipment and their dark-sky spot in Oregon. She had legendary enthusiasm for lunar observations.”

Uncle Bob Suryan recalled that, “Pat was such a happy soul. I will truly miss her smile and good humor.”

The editor regrets that he only got to know Pat a little over the last three years or so, but always enjoyed visiting. She always had a twinkle in her eye and an impish grin that left me positive that she knew something I didn’t.

Our sympathies from SAS to all who knew and loved Pat. She will be missed.

Hubble: Past and Future

Continued from page 1

Those photos were of the Cat's Eye nebula, and they revealed intricate detail and structure that scientists didn't expect and still haven't explained.

Amateur astronomers know atmosphere and sky glow are the enemy. Balick says those are good reasons to have a scope in space. Being in space also extends the spectrum of light you can look at from the infrared to the ultraviolet, and that's where the new WFC3 will really put Hubble to the test.



UW astronomy Professor Bruce Balick helped design the WFC3 that will be installed on the Hubble Space Telescope next year. Greg Scheiderer photo.

"Hubble is optimized for the optical," Balick noted, "but if you push it a little bit it works in the infrared and the ultraviolet windows as well. In fact, the camera that I've been working on has been designed to be the first camera that really exploits the ultraviolet

imaging potential of the telescope." The technology of WFC3 also is generations better than that of the Hubble camera it will replace.

The next upgrades to Hubble will be the last. NASA is scrapping the shuttle program and there's no other way to get to Hubble to do repairs. "There is no plan anywhere in NASA's books for an ultraviolet-sensitive astronomical facility after Hubble," Balick lamented.

"Hubble is the end of the line for ultraviolet experiments for many, many years to come. So

in the final repair mission, there was a big emphasis placed on working the ultraviolet."

On that mission astronauts will essentially do a complete makeover of Hubble, taking up everything they can think of that needs to be replaced, including batteries, gyros, and various instruments. Balick says that will give Hubble another 10 years of working life. With the James Webb Space Telescope scheduled to launch in 2014, their missions will overlap.

"For a little while – keep your fingers crossed – we'll have both of the telescopes in operation," Balick noted. "They're very important, they complement one another."

Balick stressed that Webb will be a different tool. "This is not an optical telescope, and that was a deliberate choice," he explained. "We only have so much money, and you have to come up with a list of scientific priorities and then design the telescope around those priorities. The agreed priorities for this telescope are the high-red-shift galaxies, the ones way out there at the edge."

Hubble will always have one up on Webb. "Because the wavelength of infrared light is much longer than optical light, the quality of the images from James Webb will not be as good as they are from Hubble," Balick said. "The best, clearest pictures that you're going to see are Hubble images."

Balick is clearly a big Hubble fan, and he'll be sad to see it go.

"Hubble has given us such a wonderful treasure of new discoveries, and we are sorry to lose it," he said. "But you have to move on, and the visible edge of the universe is really the frontier of broadest interest in astronomy."



The Space Telescope Science Institute – <http://www.stsci.edu/hst/wfc3> – has lots of technical information on WFC3. Balick has an article on planetary nebulae in the December issue of *Astronomy*.

'Tis the season for exploration

by Ron Hobbs

As the year draws to a close, I am finishing my eighth year as a Solar System Ambassador for the Jet Propulsion Laboratory. It has been my honor to be a part of this innovative outreach program, designed to find “dedicated volunteers who like to share their excitement about [the] exploration of the Solar System,”¹ during what has to be one of the most exciting decades of the first 50 years of planetary discovery. What we have seen and learned, especially over the past five years, is almost overwhelming. An example of the flood of data is seen in the fact that the Mars Reconnaissance Orbiter was designed to send back 34 terabits of data, over three times more than five other missions, including Cassini, put together. To date, however, it has sent back 73.5 terabits, and though the primary science mission just ended, that fabulous telescopic camera is still working fine. I expect the flood of beautiful pictures and data to continue.

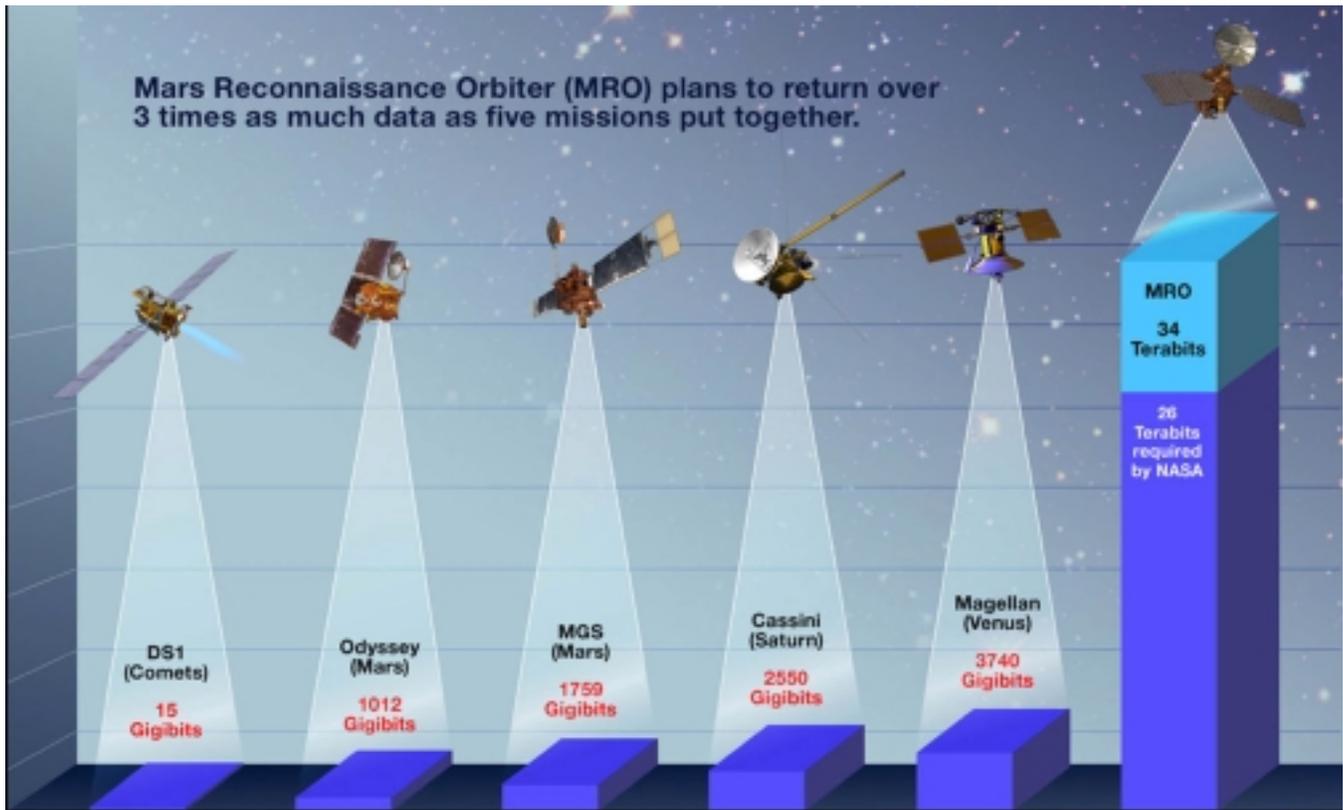
I began my tenure as an ambassador just as Cassini flew past Jupiter on its seven-year-long journey to Saturn. During that flyby, the largest and most complex robotic spacecraft yet launched by humankind performed joint observations of the giant planet with Galileo, the Jupiter Orbiter/Probe mission that had arrived in orbit in the late 1990s. The SSA program began its life as the Galileo Ambassadors, an innovative outreach program designed by the mission that had been hampered by a high-gain antenna that had refused to unfurl. This program was so successful that many other planetary missions wanted to get



involved, and so in 2000, it was expanded to include ambassadors for the entire Solar System. I found out about the program while following the Galileo mission on the Web. One of my early presentations at the Museum of Flight, where I now work full-time, was in association with Galileo’s plunge into the Jovian atmosphere in September 2003, a maneuver designed to prevent it from colliding with Europa and potentially contaminating the putative ocean beneath its icy crust.

My first presentations were done with photographic slides. (Anyone remember that primitive technology?) Pretty soon, I was downloading images directly and creating my own slides. The gargantuan task of choosing which images to show is exemplified by another statistic: Before the Mars Exploration Rovers landed nearly five years ago, a total of 7,000 images had been returned from the surface by three missions; by early December 2008, the two rovers had returned 224,883 individual images. The MER mission is now the stuff of legend. My biggest gaffe as an ambassador came when, in January 2004, I stood on the stage of the Allen Theater at the Museum and suggested that as the Rover mission was finishing up, Cassini would be arriving at Saturn. Cassini is now well into its first extended mission and the rovers are still going. I don’t feel too bad, though. Steve Squyres, MER’s principal investigator, went out on a limb and suggested that the rovers might survive as much as an Earth year, but if anyone had suggested they might survive three Martian winters and a global dust storm, they would have been dismissed as insane.

The rovers have contributed dramatically to the emerging story of liquid water in the Solar System. The brief Phoenix mission allowed us to see chunks of water ice sublimating into the Martian atmosphere. The most intriguing



The Mars Reconnaissance Orbiter was slated to return 34 terabits of information. To date, it has sent back 73.5 terabits. The primary mission has ended, but the orbiter is healthy and is continuing to study Mars as well as providing communications relay. Image courtesy NASA/JPL.

discovery of the past five years has to be Cassini's discovery of geysers of ice particles shooting out of the south pole of the Saturnian moon, Enceladus. There is a real possibility that these geysers are fed by a body of liquid water in contact with hot rock, an ideal environment for the emergence of life. Complex organic molecules have already been discovered in the ice plumes, and we are awaiting the results of two very close flybys this past summer. Carolyn Porco has admirably reviewed the emergence of this discovery in the December issue of *Scientific American*.² I highly recommend this well-written piece.

There are now over 500 active ambassadors throughout the country. The bulk of my presentations over the past eight years have been with The Museum of Flight; most of those have been with K-12 educators through the Museum's Challenger Learning Center. However, I have gone to schools throughout Wash-

ington, to senior centers, to a Lion's Club, and, more recently, to the astronomy clubs, including my own SAS. There are still many discoveries in the pipeline, and I look forward to another decade of sharing the excitement of this epic journey of discovery and interpreting the fascinating new views of our local neighborhood in this awesome universe. ★

Ron Hobbs is the Public Programs Assistant for The Museum of Flight and a Solar System Ambassador for NASA's Jet Propulsion Laboratory. For more information on the SSA program see www2.jpl.nasa.gov/ambassador.

¹ JPL. NASA "Ambassadors" Share Space Day Excitement with Public. solarsystem.jpl.nasa.gov/news/display.cfm?News_ID=888

² Porco, C. The Restless World of Enceladus. *Sci. Am.* 299(6):52, or www.sciam.com/article.cfm?id=enceladus-secrets

What happened to Comet Holmes?

by Dr. Tony Phillips

One year after Comet 17P/Holmes shocked onlookers by exploding in the night sky, researchers are beginning to understand what happened.

“We believe that a cavern full of ice, located as much as 100 meters beneath the crust of the comet’s nucleus, underwent a change of phase,” says Bill Reach of NASA’s Spitzer Science Center at the California Institute of Technology. “Amorphous ice turned into crystalline ice” and, in the transition, released enough heat to cause Holmes to blow its top.

Anyone watching the sky in October 2007 will remember how the comet brightened a million-fold to naked-eye visibility. It looked more like a planet than a comet—strangely spherical and utterly lacking a tail. By November 2007, the expanding dust cloud was larger than Jupiter itself, and people were noticing it from brightly-lit cities.

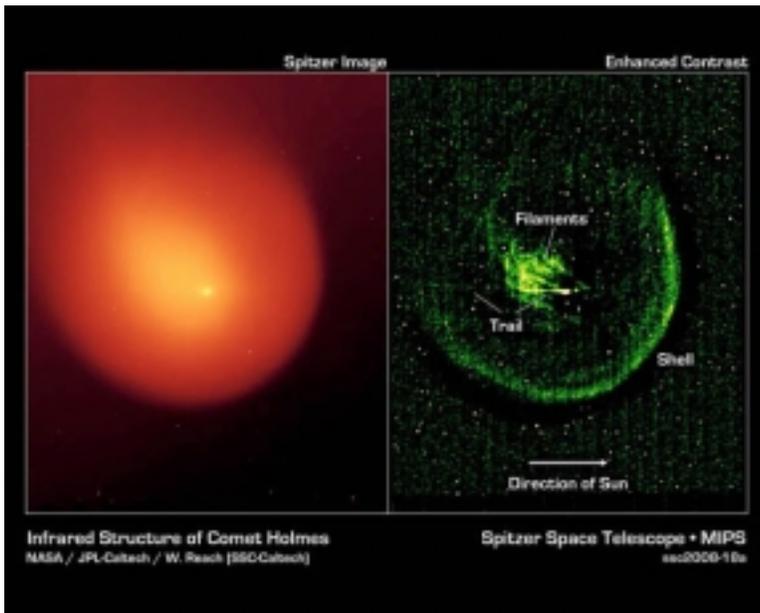


Knowing that infrared telescopes are particularly sensitive to the warm glow of comet dust, Reach and colleague Jeremie Vaubaillon, also of Caltech, applied for observing time on the Spitzer Space Telescope—and they got it. “We used Spitzer to observe Comet Holmes in November and again in February and March 2008,” says Reach.

The infrared glow of the expanding dust cloud told the investigators how much mass was involved and how fast the material was moving. “The energy of the blast was about 10^{14} joules and the total mass was of order 10^{10} kg.” In other words, Holmes exploded like 24 kilotons of TNT and ejected 10 million metric tons of dust and gas into space.

These astonishing numbers are best explained by a subterranean cavern of phase-changing ice, Reach believes. “The mass and energy are in the right ballpark,” he says, and it also explains why Comet Holmes is a “repeat exploder.”

Another explosion was observed in 1892. It was a lesser blast than the 2007 event, but enough to attract the attention of American astronomer Edwin Holmes, who discovered the comet when it suddenly brightened. Two explosions (1892, 2007) would require two caverns. That’s no problem because comets are notoriously porous and lumpy. In fact, there are probably more than two caverns, which would mean Comet Holmes is poised to explode again.



Comet Holmes as imaged by the multiband imaging photometer (MIPS) on the Spitzer Space Telescope. The enhanced contrast image at the right shows the comet’s outer shell and mysterious filaments of dust.



***Burley's Backyard.** While we Seattleites were cursing the clouds as usual, Burley Packwood shot this photo of the conjunction of the Moon, Venus (lower left) and Jupiter from his backyard in Green Valley, Arizona on the evening of Dec. 1, 2008. OK, he admits the rock formation at the right is actually from a different photo he took at Sabino Canyon north of Tucson, but says that's better than the "butt ugly" skyline from his backyard. The photo was made with a Nikon D300 mounted on a tripod.*

When?

"The astronomer who can answer that question will be famous!" laughs Vaubaillon.

"No one knows what triggered the phase change," says Reach. He speculates that maybe a comet-quake sent seismic waves echoing through the comet's caverns, compressing the ice and changing its form. Or a meteoroid might have penetrated the comet's

crust and set events in motion that way. "It's still a mystery."

But not as much as it used to be. ★

This article was provided by the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.



The Webfooted Astronomer
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**NEXT MEETING
 December 17**

Maxine Nagel's
 constellation quiz

Details, page 1



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