



The Spectrogram

Four new moons found orbiting Saturn

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Fact of the Month

A space vehicle needs to be moving at a rate of at least 7 miles per second to escape Earth's gravitational pull. That's about the same as going from New York to Philadelphia in 20 seconds!

An international team of eight "satellite hunters," astronomers who pluck tiny specks of light out of the distant solar system, has discovered four new outer moons of Saturn orbiting at least 15 million kilometers (more than 9 million miles) from the surface of the giant planet. The discovery gives Saturn a total of 22 known moons, surpassing the 21 orbiting Uranus. Nothing is known about the four new moons except for their brightness. Estimates of their size -- between 10 and 50 kilometers (6-30 miles) across -- are based on assumptions of their reflectivity. Observed from Earth-bound observatories, the moons appear as faint dots of light moving around the planet. Members of the team, including former Cornell University researcher Brett Gladman and Cornell professors of astronomy Joseph Burns and Philip Nicholson, warn that the findings are still preliminary. They also note that they might have discovered several other objects that could be Saturnian moons. The discovery of the four moons will be reported today (Oct. 26, 2000) at the annual meeting of the Division for Planetary Sciences, American Astronomical Society, in Pasadena, Calif. Other members of the team include Jean-Marc Petit and Hans Scholl of the Observatoire de la Cote d'Azur, France; J.J. Kavelaars of McMaster University, Canada; and Matthew Holman and Brian Marsden of the Harvard-Smithsonian Center for Astrophysics. The discovery of the four new moons was made using a technique developed by Gladman while he was a student at Cornell. Gladman, who now works for the Centre National de la Recherche Scientifique in France, obtained his Ph.D. at Cornell. The technique, which also was used in the discovery of the five new Uranian moons, uses light-sensitive semiconductors, called charge-coupled devices, attached to telescopes to detect the distant points of light. Several of these digital images, taken once every hour, are then compared, using computer software to pick out a moving point of light against the known star background of the sky.

Between 1997 and 1999, the same team discovered a total of five new moons of Uranus. All five, like the newly discovered four outer moons of Saturn, are irregular satellites. Burns notes that an irregular satellite's orbit is "long and looping," unlike the orbit of an inner moon, which is nearly circular and lies in the planet's equatorial plane. The great distance that the moons orbit from Saturn, says Nicholson, indicates that the moons were captured into orbit after the planet formed, unlike the larger regular satellites that are thought to have coalesced from a disk of dust and gas that surrounded the planet as it formed. Until this latest discovery, Saturn was known to have only one irregular, outer satellite, Phoebe, which was discovered by W. Pickering 102 years ago. Nicholson notes that Phoebe is traveling in a retrograde orbit, that is, in the opposite direction to the spin of Saturn.

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Important Announcements

- **The next S*T*A*R meeting** will be held on Thursday, December 7, 2000 at 8 PM at the Colts Neck Fire House #2 on Conover Rd. in Colts Neck. Due to the Holiday season, we have scheduled this meeting as our "Beginner's Night." A number of telescopes ranging widely in make, model and design will be on hand for newcomers to get a chance to see "real telescopes." STAR members will also be in attendance to offer advice and to answer questions. **Directions:** From Rt. 520, turn south onto Rt. 34. Conover Rd. is on the right, one light south of Rt. 520. From Rt. 537, turn north onto Rt. 34. Conover Rd. is on the left, two lights north of Rt. 537. The fire house is on the right, just a couple of blocks off of Rt. 34.
- **The Spectrogram NEEDS you! Again I ask members to help with content for the newsletter. Aside from Paul Nadolny, it seems that what I print is all what I PERSONALLY choose to print. Please consider taking some time to contribute interesting stories for the newsletter. If you would like to contribute an article, or news item, or if you have questions or suggestions, please contact me via email at fblock@monmouth.com.** Also, if you have been receiving the newsletter in the mail and have an email address, help us reduce the number of paper newsletters by reading The Spectrogram online! Please let John Gasparini know your email address.
- **STAR Store!** At the December meeting, I'll be discussing the new STAR merchandise store that I created on the web recently. The store is NOT OPEN for sales but can be viewed as a DEMO by going to the address at <http://www.cafepress.com/star>. Please contact me with questions.
- **I need a volunteer** to update the voice mail message at the club's new toll free number once a month. Please contact me if interested.
- **Bad Email Addresses:** While sending out the November newsletter I got a few bounces from bad email addresses. Please make sure to notify John Gasparini our Treasurer with any updates to your email address. Here are some of the addresses: Jackson-5@worldnet.att.net, rnpaul@lucent.com, craiglewis@att.net. All of these were user unknown or invalid recipient errors.
- **Have you paid your dues?** If not, please contact John Gasparini at the December meeting to square up.

Hubbles' "Backup" Mirror has a New Home...



Officials at the Smithsonian Institution's National Air and Space Museum are proud recipients of the Hubble Space Telescope's fabled backup primary mirror. The flight spare arrived at the museum early yesterday from its decade-long storage in Danbury, Connecticut. According to museum spokesperson Claire Brown, the mirror is a featured centerpiece of a planned exhibit called "Explore the Universe," scheduled to open in late 2001. "Our plan is to put the mirror itself on display starting December 16th as a tease for the larger exhibit," Brown said.

This backup mirror was built for the HST project by Eastman Kodak Corp. as a spare in case the flight-destined one was damaged prior to launch. It's the same size and weight as its on-orbit sibling (built by Perkin-Elmer Corp.), but does not have the spherical aberration that plagued HST during its first years of operation. Kodak supervised its shipment and supplied technical expertise as the museum readies the mirror for its public debut.



NASA to Announce 'Major' Mars Discovery

NASA will announce Dec. 7 that scientists have made a 'major' discovery on Mars using images acquired by the orbiting Mars Global Surveyor spacecraft. Imaging scientists Michael Malin and Ken Edgett will present what they describe as their "most significant discovery yet" during the press conference, scheduled for 2 p.m. Eastern Standard Time (19:00 GMT) at NASA Headquarters in Washington. Further details of the findings are to be published in the Dec. 8 issue of the journal *Science*, but remain under embargo until the time of the press conference. The two scientists captured the world's attention in June, when they announced they had used the Global Surveyor's Mars Orbiter Camera to image dozens of sites where liquid water appeared to have flowed on the Red Planet's surface in the geologically recent past. That finding is significant, since it bolsters the odds that Mars may have once — or still may yet — been an abode for life.

Also expected at the Thursday science update are:

- Jim Garvin, the Mars exploration program scientist at NASA Headquarters;
- Ken Nealson, director of the Center for Life Detection at NASA's Jet Propulsion Laboratory;
- Ed Weiler, NASA's associate administrator for space science, NASA Headquarters, Washington, D.C., who will moderate the discussion.

Due to coverage of the ongoing shuttle mission, the press conference will not be broadcast on NASA TV.

New Moons Around Saturn... (Continued)



All regular satellites move on prograde orbits that follow the direction of the spin of their parent planet. "We look for such patterns because it's easier to capture objects from a solar orbit into a retrograde than onto a prograde orbit," says Nicholson. "If you could demonstrate statistically that retrograde orbits were favored, that would help confirm some theories of capture."

The first two candidates for newly discovered satellites of Saturn were spotted by Gladman using the European Southern Observatory's 2.2 meter telescope in Chile on Aug. 7. Gladman and Kavelaars "recovered" the two objects Sept 23 and 24 at the Canada-France-Hawaii 3.5 meter telescope on Mauna Kea, Hawaii. They also found two new candidates. Additional confirming observations were made at other telescopes.

Last Month's Leonids – An Observing Report – *By Paul Nadolny*



Did anyone watch the Leonids on Friday night / Saturday morning? I watched from my backyard in Howell, and here's what I saw. From midnight to 1:00 am, I counted 10 Leonids. I took a break from 1:00 am to 2:15 am. From 2:15 to 3:15 am, I saw 53 Leonids and 1 sporadic meteor. I blocked the moon by positioning myself so my house was in the way. I generally looked in the direction of Procyon. Most of the meteors were un-interesting, but there were about 5 that left really nice glowing trails. Seeing so many meteors, it was obvious they were all radiating from about where the moon was. I can only imagine how many meteors I would have seen from a dark site if the moon weren't in the way...



Cherry Springs Report – *By Frank Loso*

Cherry Springs. In a word - SPECTACULAR! I can't imagine a darker, clearer sky than we saw on Saturday. When the double cluster was overhead, it was hard to tell where cluster edge was (in 8" f/7 at 30x) because the surrounding milky way was so bright. To add to the experience, the aurora we saw was as bright as the skyglow of NYC as seen from Keyport. I've only seen aurora once before (at Stellafane about 10 years ago) and I thought that was indescribable. This aurora beat that one hands down. Color was prominent, mostly red mixed in with the overall white/blue glow, and there were rays like searchlights which pulsed up well above polaris. There were rolling bands like bright waves of light. At times the brightness obscured some of the stars in the bowl of the big dipper. I took some pictures at 28 and 50mm, and am anxious to see if I captured any of this, but even if I did I'm sure they will not do justice to the live experience. On the deep sky front, I was able to see Stephans Quintet in the 8 inch. The individual members were not clearly resolved, but there was a glow visible from the knot of galaxies. The Helix was bright with detail visible even when it was only about 30 degrees off the horizon. Same with the nebulosity in M16. Nebulosity around zeta orion was plainly visible, including the wall of nebulosity to the south, but there was not quite enough contrast to see the horsehead. I tried all combinations of magnification and tried deep sky and UHC filters, but the closest I came was a hint of it at 200x with no filter. I guess I need to try a H beta filter. Overall, the views of everything were far better than anywhere else I've observed from. Cherry Springs is truly THE place.

What's in the Sky This Month (*From Skypub.com*)



- The **Geminid meteors** are due to peak on the night of **December 12–13**. But this year the Moon is nearly full and itself in Gemini, shining at magnitude -12. **This is a good year to watch for the Ursids**, a lesser shower that may produce about 10 slow meteors per hour during a brief maximum sometime around the night of **December 22–23**. But major outbursts of activity are known to have occurred in 1945 and 1986, and others may have been missed. The shower's radiant, in the Bowl of the Little Dipper, is circumpolar but highest before dawn.
- **During the partial eclipse of the Sun on December 25, 2000**, the Moon passes slightly north of the Sun's center as seen from nearly all parts of North America south of the Arctic Circle. No place on Earth will see a "central" eclipse - total or annular - though at its maximum (17:35 Universal Time) about 72 percent of the Sun's diameter will be covered as seen from remote parts of northern Canada. Skywatchers will see different-sized bites missing from the Sun's disk at mid-eclipse, at different times, depending on where they are in North America. For example, 56 percent of the Sun's diameter will be covered for residents of New York City at 12:47 p.m., while those in Los Angeles get only 15 percent coverage at 8:23 a.m. Remember, safety is paramount. Do not look directly at the Sun without using a safe solar filter. More details, including local circumstances of the eclipse, viewing tips, observing projects, and photographic hints appear in the December 2000 issue of Sky & Telescope. Check out <http://www.skypub.com> for additional information including Solar Eclipse Safety, Tips for Photographing a Partial Solar Eclipse, Solar-Filters: Which is Best], and A New Standard in Solar Filters.
- **Venus shines impressively high and bright** in the southwest during dusk. Even well after dark, it remains in prominent view low in the west. Mark your calendar to be sure to step out at dusk on December 29th to see the crescent Moon shining near Venus -- an unusually close and beautiful pairing.
- **Mars comes up around 2 or 3 a.m.** but the best time to observe it is at the beginning of dawn, when it's higher in the southeast. Mars spends December in the vicinity of Spica, passing less than 4 degrees from this star on the 13th.



Astronomical Fact and Fiction – by Paul J. Nadolny

How many times have you heard the following puzzled exclamation: “But I thought that the North Star was the brightest star in the sky!” Usually, it is said right after you point out disappointingly dim Polaris, or after you point out Sirius, which turns out not to be the North Star. Why do so many people have the misconception that the North Star is the brightest star in the sky?

The misconception is reinforced often through popular entertainment. Since it is December, I will point out that the one-hour animated Christmas special “Santa Claus Is Coming To Town” has reinforced this misconception in malleable young minds every year for 30 years! Toward the end of the story, the narrator explains that the reason Mr. and Mrs. Claus got married at the North Pole is because they wanted to get married under the light of the North Star, the brightest star in the sky. (Note that this scene was omitted from the video version. Maybe someone pointed out the problem?)

How did this misconception get started? After all, as Earth precesses on its axis, the North Pole points toward different stars (or none at all) while it slowly traces out an imaginary circle in the sky 47 degrees wide. Currently, the North Celestial Pole (NCP) is about 45 arcminutes from Polaris, or about three moon-widths. In 1776, the NCP was nearly 2 degrees from Polaris. When Columbus sailed the ocean blue, the separation was $3\frac{1}{2}$ degrees. In fact, in about the year 400, the NCP was $9\frac{1}{2}$ degrees away from Polaris and from Kochab (in the bowl of the Little Dipper), two nearly equally bright stars, neither one of which is the brightest in the sky. Back in –2800, Thuban (alpha Draconis) was a very accurate North Star, although it was just $\frac{1}{3}$ as bright as Polaris or Kochab. In fact, you have to go back to –11600 to find a brighter North Star than Polaris or Kochab. The NCP was near Vega, which was almost six times brighter than Polaris and Kochab. But Vega was not the brightest star in the sky, although it was in the top five. Still, that is too far into the past to account for today’s misconception about the North Star.

If we broaden the meaning to mean “one of the brightest”, we are on firmer ground. Polaris is almost exactly magnitude 2.0, and ranks about 50th in apparent brightness. Since there are about 6,000 stars visible to the unaided eye, Polaris is easily in the top 1%, graduating *summa cum laude* from Stellar University.

Maybe we are taking the meaning of “brightest” too literally as astronomers. After all, you do not need sunglasses to look at the brightest kid in the class! I think that the best way to correct this misconception is to think of the role that Polaris has played in the recent history of navigation. On any clear night on Earth’s Northern Hemisphere, you can always determine which way is north (and thus east, west, and south) by finding Polaris in the sky. It was not too many centuries ago that great sea voyages depended on the nearness of Polaris to the NCP. In this respect, Polaris is the *most important* star in the sky.

A related misconception that I’d like to mention is “as constant as the North Star”. As I said earlier, the NCP is 45 arcminutes away from Polaris. This means that Polaris makes a circle around the NCP, just like all the other stars do. As long as you don’t need to know North within less than one degree, you are okay. If higher accuracy is needed, remember that twice each day, Polaris truly indicates due North. This happens when Polaris is 45 arcminutes directly above or below the NCP.

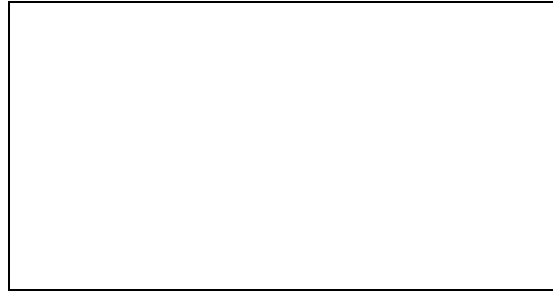
There are other ways that the North Star is not constant. As explained above, Polaris has not always been at the same distance from the NCP, and will not always be the North Star. Also, Polaris is actually a Cepheid variable, which means that its brightness changes on a predictable cycle related to its intrinsic luminosity. The changes are currently too small for the eye to notice, but they have been larger in the past (which means even the changes in brightness are changing!). Maybe this is where the saying “the only constant in life is change” comes from!

So the North Star is neither the brightest star nor the most constant star. But in the history of navigation, it sure is at the top of its class.

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Here it is! This month's issue of...

THE SPECTROGRAM

This Month's Puzzle

Name the planet with the:

- A. Greatest density
- B. Greatest range of temperatures.
- C. Strongest winds.
- D. Greatest oblateness (flatness).
- E. Most extreme seasons.
- F. Longest synodic period relative to the Earth.
- G. Hottest surface.
- H. Highest escape velocity.
- I. Greatest orbital eccentricity.

Answers are at the bottom of page 3. Don't cheat!