Southwest Florida Astronomical Society
SWFAS

The Eyepiece
March 2011

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A MESSAGE FROM THE PRESIDENT

Well, Time has really flown this short month. (Speaking of Time, that is the topic for the presentation at the meeting March 3rd.) This month we did a lot! We had 3 events at the Northwest Regional Library, a classroom presentation at Gulf Elementary, another presentation at Littleton Elementary for their Science Night, the monthly presentation at Hickey's Creek with Kelly Williamson and of course, a big success at the Burrowing Owl Festival. This followed last month's big success at the Edison Day of Discovery. I would like to thank club member Ron Apple for the use of his PST for these events, it has been a big hit.

Our meeting is the 3rd at 7:30 at the Calusa Nature Center Planetarium. John Fishwick will do a talk entitled *Time*.

This month we have another Hickey's Creek night on the 4th, followed by a CRP star party on the 5th. On the 11th, we have a public star party at 7pm at Rotary Park in SW Cape Coral. We are also trying to setup another Gulf Elementary classroom presentation, as we got clouded out last month. There are several other schools and organizations that are interested in having us do programs for them. Anyone who is interested in helping with presentations during school hours, please let me know. We have more requests than we can readily fill at this time.

As for the Loan-a-Scope program, 4 scopes are out, and a few more would have gone out at the Burrowing Owl festival, except they couldn't carry them on bikes! I will bring what is left to the Star Party on the 11th.

I would like to extend a special thank you to Tom and Sue Pick of Sanibel for the donation of the CPC-800 telescope. It is a wonderful telescope and works well with the Hα Prominence Filter that the club owns. Our primary goal with this telescope is public outreach, but we will make it available to experienced, trained club members, provided they bring it to any public events we have at the time they are using it. I will have it setup at the club meeting so that all can see it. I would also like to thank Richard Finkel of Captiva Cruises who helped coordinate the donation of the telescope to the club. Richard leads night astronomy cruises. (http://www.captivacruises.com)

President's Message Continues...

I am interested in setting up an observing evening in the Sanibel area. Richard has done events like this in the past and will see if I can coordinate something with him.

We will be updating our membership list to the Astronomical League, so please make sure that your dues are paid! Dues are $20 for the year, and can be paid at our monthly meetings, or mailed to our post office box i.e. Southwest Florida Astronomical Society, Inc., PO Box 100127, Cape Coral, Florida 33910. Your continued support is greatly appreciated. If you have a question as to whether you have paid your 2011 dues already as some members have, please contact our Treasurer Stewart Rorer.

If anyone wants a SWFAS shirt/hat, they can be ordered at any time. The cost for the shirt is $24 and the hat is $6. Payment should be made by check payable to SWFAS and given to our Treasurer, Stewart Rorer.

The sky this month:
Jupiter and Uranus are rapidly disappearing in the evening sky.
Saturn is rising earlier each night and will be near opposition at the end of the month. This makes it will placed for observation.
Venus is still shining bright in the morning sky.
Mercury will be at greatest elongation in the western sky on the night of the 23rd.
On the 27th, Venus and Neptune are extremely close: Venus at -4.0 and Neptune at 8.0. This may be your best bet to locate Neptune easily.
Spring arrives on the 21st.

March Meeting

John Fishwick will do a talk entitled *Time* for the March 3rd meeting.

Surprise Hidden in Titan's Smog: Cirrus-Like Clouds

Every day is a bad-air day on Saturn's largest moon, Titan. Blanketed by haze far worse than any smog belched out in Los Angeles, Beijing or even Sherlock Holmes' London, the moon looks like a dirty orange ball. Described once as crude oil without the sulfur, the haze is made of tiny droplets of hydrocarbons with other, more noxious chemicals mixed in. Gunk.

Icky as it may sound, Titan is really the rarest of gems: the only moon in our solar system with an atmosphere worthy of a planet. This atmosphere comes complete with lightning, drizzle and occasionally a big, summer-downpour style of cloud made of methane or ethane-hydrocarbons that are best known for their role in natural gas.

Now, thin, wispy clouds of ice particles, similar to Earth's cirrus clouds, are being reported by Carrie Anderson and Robert Samuelson at NASA's Goddard Space Flight Center. The findings were made using the composite infrared spectrometer on NASA's Cassini spacecraft.

Unlike Titan's brownish haze, the ice clouds have the pearly white appearance of freshly fallen snow. Their existence is the latest clue to the workings of Titan's intriguing atmosphere and its one-way "cycle" that delivers hydrocarbons and other organic compounds to the ground as precipitation. Those compounds don't evaporate to replenish the atmosphere, but somehow the supply has not run out yet.

"This is the first time we have been able to get details about these clouds," says Samuelson, an emeritus scientist at Goddard. "Previously, we had a lot of information about the gases in Titan's atmosphere but not much about the [high-altitude] clouds."

Compared to the puffy methane and ethane clouds found before in a lower part of the

atmosphere by both ground-based observers and in images taken by Cassini's imaging science subsystem and visual and infrared mapping spectrometer, these clouds are much thinner and located higher in the atmosphere. "They are very tenuous and very easy to miss," says Anderson, the paper's lead author. "The only earlier hints that they existed were faint glimpses that NASA's Voyager 1 spacecraft caught as it flew by Titan in 1980."
- Written by Elizabeth Zubritsky/NASA Goddard Space Flight Center,
The full story is online at: http://www.nasa.gov/mission_pages/cassini/whycassini/titan-clouds.html .

Kepler Spacecraft Detects More Than 1,200 Possible Planets

NASA's planet-hunting Kepler space telescope detected 1,235 possible extra-solar planets during its first four months of operation, including 68 approximately Earth-size worlds. Five of those are orbiting in the parent star's habitable "Goldilocks" zone where liquid water could exist in environments favorable for life.

The planetary "candidates" must be confirmed by additional observations and analysis and it will take another two years to collect enough data to determine how common Earth-like worlds might be. But based on the initial results, "Kepler's blown the lid off everything we know about extra-solar planets," said Debra Fischer, an astronomer at Yale University.

Launched from Cape Canaveral on March 6, 2009, Kepler's 95-megapixel camera is aimed at a patch of sky in the constellation Cygnus that's the size of an out-stretched hand, a 10°-wide target zone that contains more than 4.5 million detectable stars.

Of that total, some 300,000 are believed to be the right age, have the right composition and the proper brightness to host Earth-like planets. More than 156,000 of those, ranging from 600 to 3,000 light years away, will be actively monitored by Kepler over the life of the mission.

The spacecraft's camera works like a photometer, continually monitoring the brightness of target stars in the instrument's wide field of view, on the lookout for subtle changes that might indicate a planet passing between the star and the telescope. By studying those subtle changes in brightness - comparable to watching a flea creep across a car's headlight at night - and by timing repeated cycles, computers can identify potential extra-solar worlds even though the planets themselves cannot be seen.

But it's a challenging observation. For a planet like Earth passing in front of a star like the sun, the star's light would dim by just 84 parts per million, or less than 1/100th of 1 percent.

To make sure an observation indicates the presence of a real planet and not some other phenomena, measurements over multiple orbits are required, along with observations using large ground-based telescopes. For Earth-like planets in habitable-zone orbits, a full three years will be needed to confirm an initial observation.

"We found 1,200 candidates in this single field of view," said William Borucki, the Kepler principal investigator. "Imagine that we had that field of view covering the sky. Kepler looks at a 400th of the sky. If we had 400 of these fields of view, we'd see 400 times that number of candidates. We would see 400,000 candidates.

"What that's telling you is the stars around us have a huge number of planets and candidates for us to look at. And if we find that Earth's are common ... in the habitable zones of stars, very likely that means life is common around these stars. Kepler is the first step in mankind's exploration of the surrounding galaxy to find life, and the extent of life, in our galaxy."

Before the briefing, the Extrasolar Planets Encyclopaedia maintained by the Paris Observatory listed 519 planet candidates beyond Earth's solar system, including nine discovered earlier by

Kepler. Last year, the Kepler team announced 700 planetary candidates. The Kepler total now stands at 1,235 candidates, with 15 confirmed planets.

The candidates include 68 Earth-size planets, 288 so-called "super" Earths, 662 Neptune-class worlds, 165 roughly the size of Jupiter and 19 bodies much larger than Jupiter. Fifty-four candidates orbit their parent stars in the habitable zone and 170 stars feature multiple planets.

Of the 54 candidate planets orbiting in their stars' habitable zones, five are roughly the size of Earth. But all of them orbit much closer to smaller, cooler stars than the sun. For Earth-like planets around sun-like stars, three years of data covering multiple orbits will be needed for confirmation.

"The fact that we've found so many planet candidates in such a tiny fraction of the sky suggests there are countless planets orbiting sun-like stars in our galaxy," Borucki said. "We went from zero to 68 Earth-sized planet candidates and zero to 54 candidates in the habitable zone, some of which could have moons with liquid water."

On the lookout for double star systems that could result in false readings, Kepler also has identified 1,879 eclipsing binary stars.

In addition, the spacecraft found one star system - Kepler 11 - with six confirmed planets orbiting close to the parent sun. If transported to Earth's solar system, all six would fit inside the orbit of Venus.

"Kepler-11 is a remarkable system whose architecture and dynamics provide clues about its formation," Jack Lissauer, a planetary scientist and Kepler science team member, said. "These six planets are mixtures of rock and gases, possibly including water. The rocky material accounts for most of the planets' mass, while the gas takes up most of their volume. By measuring the sizes and masses of the five inner planets, we determined they are among the lowest mass confirmed planets beyond our solar system."
- By William Harwood, CBS News Space Consultant

Astronomical Society of the Pacific Examines Astrology

In light of the recent media interest into problems with astrology and the fact that the astrological signs and astronomical constellations no longer line up, the non-profit Astronomical Society of the Pacific has updated its long-popular article examining astrology from an astronomical perspective and is making it available on the Web at http://www.astrosociety.org/astrology.pdf

(It includes the suggestion of a new "science" of jetology -- where the position of jumbo jets at the time a person is born determines his or her destiny and love life – which many educators have found useful over the years.)

There is also a resource guide for looking at a wide range of astronomical pseudo-science at http://www.astrosociety.org/education/resources/pseudobib.html
- Andrew Fraknoi

Discovery Day Photos

Explained in 60 Seconds: Pro-Am

While professional astronomers are lucky enough to make a career out of their passion, amateur astronomers enjoy observing the night sky purely for the pleasure of seeing distant celestial objects. But there are amateur astronomers who want to take their hobby further — and professional astronomers are now recognizing how amateurs can help them with their research. This kind of cooperation between professional and amateur astronomers is referred to as a Pro-Am collaboration.

Good examples of Pro-Am projects are the long-term observational studies by amateurs that are too time-consuming for professional astronomers to even consider undertaking themselves. An alternative type of Pro-Am project involves amateurs working on their own initiative to make important observations and discoveries of, for example, supernovae, which are then followed up by professionals. For example, in 2009 and 2010, amateur astronomers were the first to spot impacts on Jupiter, with their observations then pursued using professional telescopes.
The sudden surge in Pro-Am collaborations is partly due to the affordability nowadays of cutting-edge equipment, like large (8-inch or more) telescopes and high-spec CCD cameras, which bring faint celestial objects firmly within the reach of amateurs.
Hopefully, in the future, the number of Pro-Am projects will continue to grow, as they are greatly beneficial to advancing our understanding of how the Universe works.
A list of Pro-Am collaborative projects in astronomy can be found on line: http://goo.gl/WzKL2
- *http://www.capjournal.org/issues/10/10_04.php, Communicating Astronomy with the Public*

First Known Arsenic-based Life Found

The Mono Lake Research area in central California has a central role in the most controversial science media story of 2010: NASA-supported researchers have announced the discovery of the first known microorganism on Earth able to thrive and reproduce using the toxic chemical arsenic. The microorganism, which lives in California's Mono Lake, substitutes arsenic for phosphorus in the backbone of its DNA and other cellular components. However the scientific community, journalists and new media activists have been vocal in their opposition to the way NASA publicized the story and even the veracity of the findings. Maybe 2011 will shed some light on this controversial story.
- *http://www.capjournal.org/issues/10/10_04.php, Communicating Astronomy with the Public, photo credit NASA*

EarthSky's Meteor Shower Guide for 2011

Next major meteor shower is the Lyrid shower in April

April 22, 2011 Lyrids
The Lyrid meteors – April's "shooting stars" – tend to be bright and often leave trails. About 10-20 meteors per hour at peak can be expected in years when the moon is out of the way. In 2011, however, the moon will bleach out this year's Lyrid show. Uncommon surges can sometimes bring the rate up to 100 per hour, but these rare outbursts are not easy to predict. That's one of the reasons the tantalizing Lyrids are worth checking out. The radiant is in the constellation Lyra, which rises in the northeast at about 10 p.m. Unfortunately, the waning gibbous moon obstructs the view in the late night and morning hours, the best time to watch the Lyrid shower. As a general rule, the greatest number of Lyrid meteors fall in the dark hours before dawn. *Likely, the optimal night will be from late night April 22 until dawn April 23. But the glare of the waning gibbous moon will wipe out all but the brighter Lyrid meteors*.

May 5, 6, and 7, 2011 Eta Aquarids
This shower has a relatively broad maximum but is expected to show the greatest number of

meteors before dawn on May 6. Fortunately, the thin waxing crescent moon will set in early evening, leaving dark skies for this year's Eta Aquarid show. At mid-northern latitudes, 10 to 15 meteors per hour may be visible in a dark sky. Farther south – like in the southern hemisphere – the meteor numbers increase dramatically. For the most part, this is a predawn shower. The radiant for this shower appears in the east-southeast at about 4 a.m. and the hour or two before dawn offers the most meteors. The broad peak to this shower means that some meteors may fly in the dark hour before dawn for a few days before and after the predicted optimal date. *Although the most meteors will probably rain down on May 6 before dawn, the day before or after may offer a sprinkling of Eta Aquarid meteors as well.*

July 29, 2011 Delta Aquarids
Like the Eta Aquarids, this shower favors the southern hemisphere, and the tropical latitudes in the northern hemisphere. The meteors appear to radiate from the southern part of the sky. From northern temperate latitudes, the maximum hourly rate may reach 15-20 meteors in a dark sky. Unlike many meteor showers, this one doesn't have a very definite peak, despite the date given above. Instead, these medium-speed meteors ramble along fairly steadily throughout late July and early August. *An hour or two before dawn usually presents the most favorable view of the Delta Aquarids. Try the morning of July 29, from about 2 a.m. until dawn*.

August 12 and 13, 2011 Perseids
When we say August 12 or 13, we mean the morning hours after midnight – not that night. Unfortunately, the full moon will spoil this year's Perseid display, obscuring all but the brighter meteors. These typically fast and bright meteors radiate from a point in the constellation Perseus the Hero. But you don't need to know Perseus to watch the shower. The meteors appear in all parts of the sky. The Perseids are considered by many people to be the year's best shower, and often peak at 50 or more meteors per hour – in years when the moon is out of the sky. However, 2011 is not a great year for the Perseids, because the moon is full on the expected peak date. The Perseids tend to strengthen in number as late night deepens into midnight, and typically produce the most meteors in the wee hours before dawn. These meteors are often bright and frequently leave persistent trains. *On the mornings of August 12 and 13, you can still watch for some Perseid meteors to streak across this short summer night from midnight until dawn. Yet the full moon makes 2011 an unfavorable year for watching the Perseids, usually one of the best showers of the year.*

October 7 and 8, 2011 Draconids
The radiant point for the Draconid meteor shower almost coincides with the head of the constellation Draco the Dragon in the northern sky. That's why the Draconids are best viewed from the northern hemisphere. However, the big and brilliant waxing gibbous moon makes 2011 an unfavorable year for watching this shower. The Draconid shower is a real oddity, in that the radiant point stands highest in the sky as darkness falls. Unlike many meteor showers, the Draconids are more likely to fly in the evening hours than in the morning hours after midnight. This shower is definitely a sleeper, producing only a handful of languid meteors per hour in most years. But watch out if the Dragon awakes! On occasion, fiery Draco has been known to spew forth hundreds – if not thousands – of meteors in a single hour. Even if an outburst comes in 2011, the shower must complete with the light of the waxing gibbous moon. *The glare of moonlight is sure to obscure the 2011 Draconid shower, but you can try viewing it on the peak evenings of October 7 and 8.*

October 20 and 21, 2011 Orionids
The rather large waning crescent moon obtrudes somewhat on this year's Orionid meteor shower. Although the moon doesn't rise till after midnight, the Orionids usually wait until the wee morning hours to pick up steam. Despite the moonlight, meteor enthusiasts may want to give the Orionids a try anyway. On a dark, moonless night, the Orionids exhibit a maximum of about 15 meteors per hour. These fast-moving meteors occasionally leave persistent trains and

bright fireballs. If you trace these meteors backward, they seem to come from Orion's Club, or north of Orion's bright, ruddy star Betelgeuse. The Orionids have a broad and irregular peak that is difficult to predict. More meteors tend to fly after midnight, and the Orionids are typically at their best in the wee hours before dawn. *The best viewing will probably be before dawn on October 21 or 22, though the waning crescent moon may somewhat tarnish this year's Orionid display*.

November 5, 2011 South Taurids
The South (and North) Taurids are perhaps best suited to die-hard meteor aficionados. The meteoroid stream that feeds the Taurids is very spread out and dissipated. That means the Taurids are extremely long lasting (September 25 to November 25), but usually don't offer a lot more than about 7 meteors per hour, even on the South Taurids' expected peak date of November 5/6. *The big and bright waxing gibbous moon ruins the show during the evening hours on November 5, but if you're a night owl, try watching after* moonset*, or in the wee hours after midnight on November 6.*

November 11 and 12, 2011 North Taurids
This shower is long-lasting (October 12 – December 2) but modest, and the peak number is forecast at about 7 meteors per hour. Typically, you see the maximum numbers at around midnight to 1 a.m., when Taurus the Bull moves nearly overhead. This year, the bright waning gibbous moon shines right in front of the constellation Taurus, making 2011 an unfavorable year for watching these rather slow-moving but sometimes bright North Taurid meteors. *The greatest numbers of North Taurid meteors come at late night and after midnight on the nights of November 11 and 12, but you might want to write off this year's North Taurids because of the strong moonlit glare*.

November 17, 2011 Leonids
Historically, the Leonids have produced some of the greatest meteor storms in history, with rates as high as many thousands of meteors per hour. These storms sometimes recur in cycles of 33 to 34 years. Most years, the Lion whimpers rather than roars, producing a maximum of perhaps 10-15 meteors per hour. Like the October Orionids, the Leonids ordinarily pick up steam after midnight and display the greatest meteor numbers just before dawn. This year, however, the last quarter moon will be shining near the radiant point of the shower in the constellation Leo. The unwelcome presence of the moon is sure to dampen this year's Leonid display. *If you're game, you can try watching from late night November 17 till dawn November 18, though the moonlit glare will subdue the 2011 Leonid meteor shower*.

December 13 and 14, 2011 Geminids
The waning gibbous moon makes 2011 a rather unfavorable year for watching the Geminids, the year's grand finale for the major meteor showers. As a general rule, it's either the August Perseids or the December Geminids that give us the most prolific display of the year. In 2011, moonlight obscures both showers. Unlike many meteor showers, you can usually start watching the Geminids by 9 or 10 p.m. This year, however, the moon rises at mid-evening and shines all the way until daybreak. On a dark, moonless night, the Geminid meteor shower often produces 50 or more meteors per hour. *The best viewing of these often bright, medium speed meteors should be after midnight on December 14 and 15, but the bright moon will greatly lessen the number of visible Geminid meteors in 2011*.
- *http://earthsky.org/astronomy-essentials/earthskys-meteor-shower-guide*

MESSENGER Arrives at Mercury

After more than a dozen laps through the inner solar system, NASA's MESSENGER spacecraft will move into orbit around Mercury on March 17, 2011. The durable spacecraft — carrying seven science instruments and fortified against the blistering environs near the Sun — will be the first to orbit the innermost planet.

At 8:45 p.m., MESSENGER — having pointed its largest thruster very close to the direction of travel — will fire that thruster for nearly 14 minutes, with other thrusters firing for an additional minute, slowing the spacecraft by 1,929 miles per hour and consuming 31% of the propellant that the spacecraft carried at launch. Less than 9.5% of the usable propellant at the start of the mission will remain after completing the orbit insertion maneuver, but the spacecraft will still have plenty of propellant for future orbit correction maneuvers.

The orbit insertion will place the spacecraft into an initial orbit about Mercury that has a 124 mile minimum altitude and a period of 12 hours. At the time of orbit insertion, MESSENGER will be 28.67 million miles from the Sun and 96.35 million miles from Earth.

"The journey since launch, more than six years ago, has been a long one," says MESSENGER Principal Investigator Sean Solomon. "But we have rounded the last turn, and the finish line for the mission's cruise phase is in sight. The team is ready for orbital operations to begin."

Engineers recently tested the arrayed-antenna configuration that will be used during the Mercury orbit insertion. During the maneuver, MESSENGER's orientation will be optimized to support the burn, not to support communications with the team on the ground. As a result, the signal home will be weaker than usual. To boost the signal, communications engineers will use four antennas at the Goldstone Deep Space Communications Complex — one 70-meter dish and three 34-meter dishes.

"This arrangement is not typical for a maneuver, so we wanted to do a few dry runs before orbit insertion," says MESSENGER Communications Engineer Dipak Srinivasan. "We are still analyzing the data, but everything went as expected."

Since the last deep-space maneuver (DSM) almost a year and a half ago, the primary focus of the team has been on preparing for the orbit insertion maneuver and for orbital operations. Detailed plans have been developed and vetted through an extensive series of meetings ranging from internal peer reviews of each subsystem to formal reviews with external experts assessing overall readiness.

In addition to taking advantage of planned DSMs to practice aspects of the orbit insertion maneuver, the team has conducted a number of flight tests to characterize key subsystem behavior and to confirm the proper operation of various spacecraft components. Three full-team rehearsals using the hardware simulator have been conducted to practice all activities to be followed during the upcoming maneuver. The first of these exercises mimicked a nominal orbit insertion, and the following two presented anomalies for the team to recognize, analyze, and address.

- For an overview of Mercury Orbit Insertion and planned orbital observations, go online to http://messenger.jhuapl.edu/mer_orbit.html.

A Saturn Spectacular, With Gravity's Help

Left: Brent Buffington, left, David Seal and John C. Smith arranged models of Jupiter and Saturn in a viewing room at the Jet Propulsion Laboratory in Pasadena, Calif.

When it comes to voyages of discovery, NASA's venerable Cassini mission is about as good as it gets.

Below: The bright arc within Saturn's G-ring, truncated by the shadow of the planet, in an image taken aboard the Cassini spacecraft.

In six years of cruising around the planet Saturn and its neighborhood, the Cassini spacecraft has discovered two new Saturn rings, a bunch of new moons and a whole new class of moonlets. It encountered liquid lakes on the moon Titan, water ice and a particle plume on the moon Enceladus, ridges and ripples on the rings, and cyclones at Saturn's poles. Cassini also released a European space probe that landed on Titan. And Cassini has sent back enough data to produce more than 1,400 scientific papers — at last count.

But besides the science, Cassini is state of the art in the arcane discipline of orbital mechanics — how to get from one place to another in space to fulfill a mission's science requirements without running out of fuel. The plans are for Cassini to keep working for 7 more years, but it currently has only 22% of the maneuvering propellant it had when it started.

Figuring out how to more than double the duration of the mission with less than a quarter of the fuel is hard. Cassini's orbital mechanics present an astonishingly complex exercise in Keplerian physics and geometry. The enormous array of science objectives and targets — moons, rings, Saturn itself — makes it one of the most complex missions ever flown.

Brent Buffington, a Cassini mission designer, compared the task to plotting a 7-year road trip around the United States for more than 200 scientists, all with different interests and all wanting to see different things. "Now add the fact that you have a finite amount of time to design this road trip and need to adhere to the laws of physics, speed limits, the limited capabilities of the bus" and the bus driver, he said. "Oh, and the targets they want to see are moving."

Cassini arrived at Saturn in 2004 for a 4-year mission, but it was so successful that NASA gave it a 2-year extension, to September 2010. Then, in February, NASA extended it a second time for what it calls the Solstice mission, lasting until Saturn's northern hemisphere summer in 2017. If all goes as planned, on Sept. 15, 2017, Cassini will die a warrior's death, diving inside the rings for 22 spectacular orbits on the fringes of Saturn's atmosphere before plunging into the planet.

One of the fundamental tools for adjusting the trajectory of a large manufactured object in space — the essence of orbital mechanics — is the gravity assist. As a spacecraft approaches a planet or moon, gravity grips it and flings it in a different direction. In the 1970s and '80s, NASA used the gravity assist technique to enable the tiny Voyager 2 to complete its "grand tour" of the outer planets of the solar system. Voyager 2 employed four gravity assists. The Cassini Solstice mission alone will require 56.

The popular analogy for the gravity assist is "slingshot," but that term makes today's orbit designers grit their teeth. "It's a lot more sophisticated than that," said David Seal, Cassini's mission planning supervisor.

A better analogy, he said, is two ice skaters in a hockey rink: a little girl and her father. The little girl is Cassini, small and fast; Dad is slow but strong. When the little girl reaches Dad at the red line, they clasp hands and Dad rotates. He can fling his daughter farther down the ice toward the far goal, toss her at right angles into the boards, send her back where she came from or let her go off at an angle.

In Cassini's case, Dad, aptly perhaps, is Titan, Saturn's largest moon. Bigger than the planet Mercury, it is the only thing in the Saturn system, besides Saturn, with enough gravity to make radical changes in the spacecraft's trajectory every time it flies by.

The basic geometry of the Saturn system is not difficult to understand. Like Earth, the polar axes of both Saturn and Titan run from north to south and are canted slightly, which gives both the planet and its largest moon "seasons." A Saturn year lasts almost 30 Earth years. Cassini arrived at Saturn in the southern summer and will finish 13 years later in the northern summer. Being able to observe the change of seasons for half a Saturn year was the dominant principle in designing the Solstice mission.

The rings of Saturn and the vast majority of its moons, including Titan, are spread out on a roughly horizontal plane from the planet's equator. Cassini needs to fly two kinds of orbits of Saturn to get the science it wants. Equatorial orbits put the spacecraft on the same plane as the moons and the rings. Using this type of orbit, Cassini can get great views of Saturn and is able to cross the orbits of several of Saturn's icy moons for close observations and imagery. Equatorial orbits, however, make it impossible to see the rings, which appear as a knife edge in the middle of the planet. For ring observations, inclined orbits are a must. The spacecraft has orbited Saturn at latitudes as high as 74.7°, enabling the spacecraft to look down — or up — at the rings, and also to observe the poles.

Throughout Cassini's lifetime the tour designers must keep a close watch on the amount of fuel that it has for navigation. This is measured as a change in spacecraft velocity in meters/second and is known in aerospace parlance as delta-V. For example, if scientists want a closer approach to the moon Enceladus, the designers might tell them the delta-V cost is 10 meters/second, and scientists and engineers will decide whether the science is worth the expenditure.

When Cassini began, the spacecraft had 742 meters/second delta-V available, and for the initial four-year prime mission" and extended two-year Equinox mission, "the cost of doing business was about 100 meters/second per year, maybe a little more," Mr. Seal said.

That has left 158 meters/second delta-V for the next seven years. What makes the Solstice mission doable is that designers can trade time for fuel — it may cost less delta-V to reach a target if the spacecraft takes longer to get there. And each flyby of Titan adds as much as 840 meters/second of delta-V, which is the energy used for major alterations in Cassini's trajectory.

For purposes of planning, the Cassini scientists were divided into five "disciplines": those concerned with Saturn; with Titan; with the rings; with the icy satellites; and with the magnetosphere.

"It's not like any problem set you get in college, because you have so many factors pulling in different directions," Mr. Seal said. "The best way to measure it is to look at how much better the next iteration is than the previous one" until "you're only making slight improvements." Then you stop.

- By Guy Gugliotta, a version of this article appeared in print on April 20, 2010, on page D1 of the New York edition.

Explore the Milky Way from your desk

The universe is a big place. It takes months for our rockets to get to Mars. Even at light-speed, it would take years to reach the nearest star.

For the time being, we can only explore the universe through pictures. But that still presents a problem for astronomers. They capture far more pictures than they can analyze.

That's where The Milky Way Project comes in. It lets you help astronomers analyze pictures of our galaxy. And you don't need any formal astronomy training.

You just have to find "bubbles" in space. These are points of interest for astronomers. You can also flag other features you think are interesting. Astronomers will review your findings. A comprehensive tutorial walks you through the process.

The project uses infrared images from the Spitzer Space Telescope. They're beautiful to look at while you search. You can even save ones you like for later viewing!

www.milkywayproject.org

The Space Place
Thank Goodness the Sun is Single

By Trudy E. Bell

It's a good thing the Sun is single. According to new research, Sun-like stars in close double-star systems "can be okay for a few billion years—but then they go bad," says Jeremy Drake of the Harvard-Smithsonian Astrophysical Observatory.

How bad? According to data from NASA's Spitzer Space Telescope, close binary stars can destroy their planets along with any life.

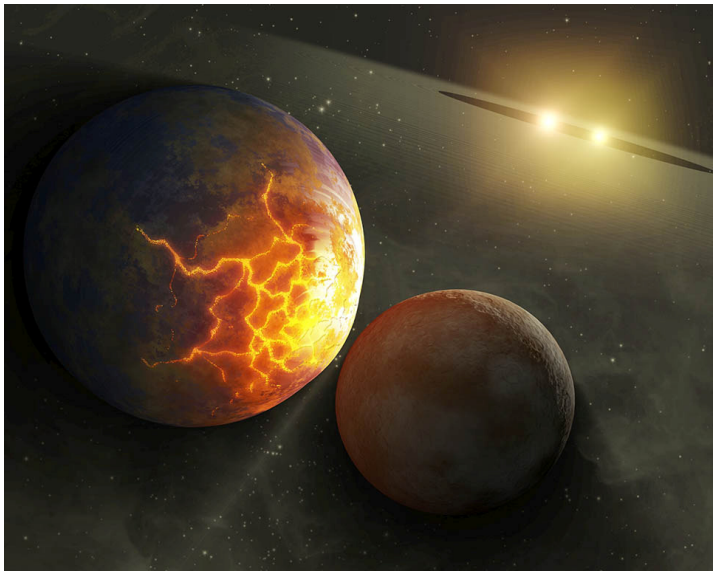
Our Sun, about 864,000 miles across, rotates on its axis once in 24.5 days. "Three billion years ago, roughly when bacteria evolved on Earth, the Sun rotated in only 5 days," explains Drake. Its rotation rate has been gradually slowing because the solar wind gets tangled up in the solar magnetic field, and acts as a brake.

But some sun-like stars occur in close pairs only a few million miles apart. That's only about five times the diameter of each star—so close the stars are gravitationally distorted. They are actually elongated toward each other. They also interact tidally, keeping just one face toward the other, as the Moon does toward Earth.

Such a close binary is "a built-in time bomb," Drake declares. The continuous loss of mass from the two stars via solar wind carries away some of the double-star system's angular momentum, causing the two stars to spiral inward toward each other, orbiting faster and faster as the distance shrinks. When each star's rotation period on its axis is the same as its orbital period around the other, the pair effectively rotates as a single body in just 3 or 4 days.

Then, watch out! Such fast spinning intensifies the magnetic dynamo inside each star. The stars "generate bigger, stronger 'star spots' 5 to 10 percent the size of the star—so big they can be detected from Earth," Drake says. "The stars also interact magnetically very violently, shooting out monster flares."

Worst of all, the decreasing distance between the two stars "changes the gravitational resonances of the planetary system," Drake continued, destabilizing the orbits of any planets circling the pair. Planets may so strongly perturbed they are sent into collision paths. As they repeatedly slam into each other, they shatter into red-hot asteroid-sized bodies, killing any life. In as short as a century, the repeated collisions pulverize the planets into a ring of warm dust.



The infrared glow from this pulverized debris is what Spitzer has seen in some self-destructing star systems. Drake and his colleagues now want to examine a much bigger sample of binaries to see just how bad double star systems really are.

They're already sure of one thing: "We're glad the Sun is single!"

Caption: *Planetary collisions such as shown in this artist's rendering could be quite common in binary star systems where the stars are very close.*

Read more about these findings at the NASA Spitzer site at www.spitzer.caltech.edu/news/1182-ssc2010-07-Pulverized-Planet-Dust-May-Lie-Around-Double-Stars . For kids, the Spitzer Concentration game shows a big collection of memorable (if you're good at the game) images from the Spitzer Space Telescope. Visit spaceplace.nasa.gov/en/kids/spitzer/concentration/.

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

Free Training
Did you know about the free training available through Night Sky Network? Star party season is approaching and many amateur astronomers love sharing the universe with the public. Whether you're just getting started or are an old pro, this series of short training videos address some common questions amateurs have about doing outreach.
What tips will you find most valuable?
http://www.astrosociety.org/SharingTheUniverse/

Telecon Dates Exclusive - solely for NSN Members
Talk directly with scientists and outreach specialists working with NASA Missions! These upcoming telecons are exclusively for Night Sky Network members like you. Be sure to mark your calendar:

March 24th: Views from EPOXI: Colors in Our Solar System with Carolyn Crow,
http://nightsky.jpl.nasa.gov/club/news-display.cfm?News_ID=406

May 19th: Stargazers, Starfarers, and Kepler, with Dr. Jeffrey Van Cleve,
http://nightsky.jpl.nasa.gov/club/news-display.cfm?News_ID=409

July: Watch for the announcement!

September 22nd: Exploring the Dark Side of the Solar System using WISE with Dr. Ned Wright,
http://nightsky.jpl.nasa.gov/club/news-display.cfm?News_ID=407

Win a Kit and Meter!
Your club has TWO opportunities to win a GLOBE at Night (GaN) Kit and Sky Quality Meter! Here's how:
a. Help protect our night skies by using the GaN Activity Packet to record the brightness of the night sky at any of your astronomy outreach events held during the two campaigns:
February 21 - March 6, 2011, GaN Activity Packet:
http://www.globeatnight.org/pdf/M-GaNActivityPacket_Family_2011_Orion_Color.pdf (featuring Orion)
March 22 - April 4, 2011, GaN Activity Packet:
http://www.globeatnight.org/pdf/M-GaNActivityPacket_Family_2011_N_Leo_Color.pdf (featuring Leo)

b. Record your measurements here: http://www.globeatnight.org/report.html

c. When you log your event on Night Sky Network, under Topics Covered, check off "Globe at Night (GaN)" and your event will be entered in the drawing.

Your GaN events held February 21 - March 6, 2011, must be logged on Night Sky Network by March 8th to be entered into the drawing for one of five GLOBE at Night (GaN) Kits with Sky Quality Meter. DRAWING WILL BE HELD ON MARCH 9th.

Your GaN events held March 22 - April 4, 2011, must be logged on Night Sky Network by April 6th to be entered into the drawing for one of five GLOBE at Night (GaN) Kits with Sky Quality Meter. DRAWING WILL BE HELD ON APRIL 7th.

For more information on the GLOBE at Night campaigns: http://www.globeatnight.org

Quarterly Prizes - Brazilian Uruaçu Iron Octahedrite Meteorites
We have five more beautiful museum quality Uruaçu Iron Octahedrite meteorites from Goiás, Brazil to give away. Just hold and log two events on or before March 31st. The more you log the better your chances of winning. It's not too early to start entering all your events for the year. That way, after the events occur, you'll get a reminder in the green column: Open Items and just click on "Completed Events ready to Log" and you're almost done!
- *Marni Berendsen, Kenneth Frank and Jessica Santascoy, Night Sky Network*

SWFAS Minutes

Minutes to the January meeting will be published in a future newsletter.

Future Events

CALUSA NATURE CENTER PLNTRM	3-3-11	7:30 PM	MONTHLY MEETING
HICKEY'S CREEK MITIGATION PARK	3-4-11	7:15 PM	TELESCOPE OBSERVING
CALOOSAHATCHEE REGIONAL PARK	3-5-11	DUSK	STAR PARTY
CAPE CORAL ROTARY PARK	3-11-11	7:00 PM	TELESCOPE OBSERVING
HICKEY'S CREEK MITIGATION PARK	4-1-11	8:30 PM	TELESCOPE OBSERVING
CALUSA NATURE CENTER PLNTRM	4-7-11	7:30 PM	MONTHLY MEETING
CALUSA NATURE CENTER PLNTRM	5-5-11	7:30 PM	MONTHLY MEETING
SANIBEL DING DARLING PARK FAMILY	10-17-11	11:00 AM	SOLAR OBSERVING

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