SIRIUS ASTRONOMER

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The Newsletter of the Orange County Astronomers

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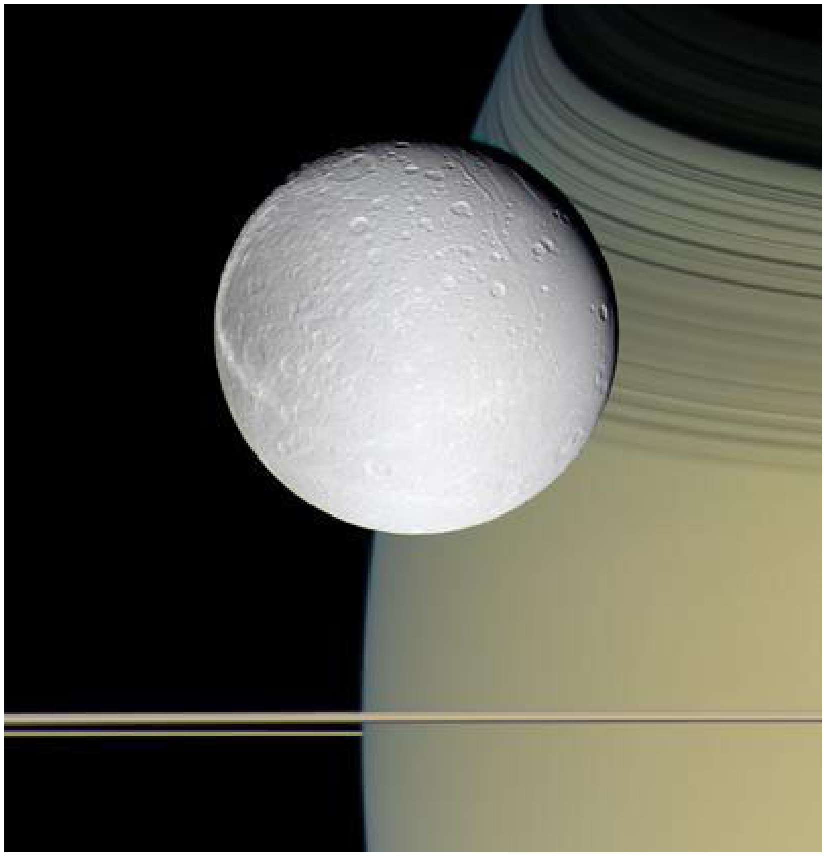


Saturn's moon Dione is seen silhouetted against the planet's disk and just above the ring plane in this image taken by the Cassini orbiter on October 11th. The dark bands at upper right are shadows cast by Saturn's rings upon the planet's cloud tops. Saturn is a late-night object this month; a moderate (6-8 inch) telescope under dark skies will reveal Dione and several other Saturnian satellites. (NASA/JPL/Space Science Institute)

OCA CLUB MEETING

The free and open club meeting will be held Friday, November 11th at 7:30 PM in the Irvine Lecture Hall of the Hashinger Science Center at Chapman University in Orange. The featured speaker this month is Dr. Tom Spirock, who will speak on solar observing at Big Bear Solar Observatory

NEXT GENERAL MEETING:

December 9th

STAR PARTIES

The Black Star Canyon site will be open this month on November 26th. Members are encouraged to check the website calendar, for the latest updates on star parties and other events.

Please check the website calendar for the outreach events this month! Volunteers are always welcome!

You are also reminded to check the web site frequently for updates to the calendar of events and other club news.

COMING UP

The next session of the Beginners Class will be held on Friday, November 4th (and next month on December 2nd) at the Centennial Heritage Museum at 3101 West Harvard Street in Santa Ana.
GOTO SIG: TBA (contact coordinator for details)
Astrophysics SIG: Nov. 18th, Dec. 16th
Astro-Imagers SIG: Nov. 15th, Dec. 20th
EOA SIG: Nov. 28th, Dec. 26th
Dark Sky SIG: TBA (contact coordinator for details)

AROUND OCA
By Barbara Toy

The year winds on, we should be in the dry Santa Ana season as I write this, but somehow high humidity is still interfering with our viewing. The Saturday after the October Anza Star Party (that is, the *first* October star party) was notable for the extremely dark conditions on site – due to the fact that we were completely fogged in. It was an interesting experience, feeling my way down the road from the observatory to Anza House – amazing how disorienting it is when the usual landmarks along the way are hidden in dense swirls of mist! That was one of the rare times I've regretted not having a white flashlight with me while moving around on site – my red light seemed to be absorbed by the fog and barely put any light on the ground at all. Of course, those who did have white lights got a lot of the light reflected back to them by the fog, so maybe a white light wouldn't have been all that much more helpful.

By the way, that weekend was typical in that those who were there that Friday night reported to those of us who couldn't make it until Saturday that the conditions had been really great, too bad we missed it. As a matter of basic Amateur Astronomy self-defense (if not etiquette), it is important under these conditions not to vent one's disappointment or frustration on the bearer of these tidings, especially as that may be exactly what the bearer is hoping for. It's a lot more effective to respond graciously, with as hearty congratulations on the other party's good luck as one can muster – and bide one's time…

AstroImage 2006

Just in case you haven't yet noted it on your calendar, the AstroImage 2006 conference is set on August 11 and 12, 2006 – these dates are posted on the OCA website calendar, in case you need to check on them. We've reserved them with the Curtis Theatre and paid the deposit, so they're pretty firm. The organizing committee (Dave Kodama, Jim Windlinger, Tom Kucharski, Garth Buckles and me) is currently meeting every two weeks, working on all of the big and little details that go into putting one of these conferences on. In the process, I've developed an even healthier respect than I had before for the planning committees for AstroImage 2002 and 2004 as I've seen first hand all of the different issues that have to be dealt with. We have some of the same personnel (Dave and Garth in particular), and we have a lot of the work that those committees did to build on, which makes our job easier in many respects, but there's still a lot of new work required.

Of course, one of the reasons for that is that we don't want to give exactly the same conference as before, with only some changes in speakers and their topics. Every one of these conferences gives people ideas for improving on them, and so we're spending a lot of time on such things as improving and expanding the Image Gallery (both the print displays and the electronic components of the gallery), improving the site conditions for our vendors and sponsors, adding program features, and so on. The formal program for Friday night will be still be geared toward people with less experience, but will be quite different in approach and content than at the past two conferences (details to follow!), and we're talking about having an actual reception as part of the evening's festivities. The Saturday program, of course, will center on the talks – not all of the speakers have been confirmed as I write this, but, from those who have, it's shaping up to be a very interesting array of subjects. Dave Kodama has been doing the lion's share of the work on getting the speakers, for which we are very grateful indeed.

To increase the depth of the program and include topics of interest beyond what can be covered in the formal talks, we're adding a poster area for the Saturday program, similar to what's done at a lot of science conferences. These will be presentations by various attendees of information they want to share with fellow imagers, and can be done as flat, wall-mounted posters or as free-standing posters similar to what is often used at science fairs, and can also incorporate pieces of equipment or other items separate from the actual poster as part of the display or demonstration. Topics could include such things as processing tips, interesting sequences of images with relevant information so people appreciate why the sequence is interesting, comparisons of different types of equipment, demonstrations of ways to improve results using different types of equipment or software, uses of various imaging techniques for research, research results, marketing of images – the major requirement is that the topic involves something related to imaging. The presenters will have to agree to be in the vicinity of their poster during one set time to discuss the subject matter with the people who come by and to answer questions; we expect these times would be at one of the breaks or at the beginning or end of the lunch hour, and the plan is to include the poster titles and presenters with these times as part of the conference program so attendees can easily review the poster topics and plan on coming by with their questions. We also want to include electronic versions of the posters on the CD of the conference proceedings.

To be one of our poster presenters, you'll need to send in a request to present a poster, giving your contact information, the title of your poster and a brief summary of the kind of subject matter you expect to cover. I'm coordinating the poster session portion of the conference, so these requests should be sent to me, either by email to **btoy@cox.net** or by regular mail care of the club's address, P.O. Box 1762, Costa Mesa, CA 92628. We're working out the details for the allowed dimensions of the posters and any other constraints, so there'll be additional details to follow – but please don't wait for them before sending me your request and topic!

Some Other Updates

Work on the observatory roof continued at the first October star party, thanks to the efforts of Tom Kucharski, John Castillo and Matt Ota. After spending a lot of time painting the support structure, which gave him good reason to look at it closely, Tom gave me his considered opinion that this work can only be expected to see us through this rainy season in reasonable safety, and it's clear that the roof replacement is a real necessity and can't be postponed too much longer. While it's nice to have confirmation of my own assessment of the situation, it would be nice to feel we have a larger safety margin. Whatever safety margin we have will be improved by finishing the sealing and painting of all of the exposed wood on the observatory, both on the moving roof and all of the supporting structure – my thanks to all of you who help us out with this at the next star party!

In case you were wondering about why Anza weather station data didn't make it to the website for a few weeks (which is still the case as I write this), we had a major failure of the server for the Anza on-site network. We owe great thanks to Tim Arden for getting us a much faster computer to use as the server, and to Jerry Mulchin for his attempts to repair the original server and to get the replacement up and running; once the new server is up and running, you should start seeing Anza weather information appearing again on the website. Working on another aspect of the on-site network, Vance Tyree has scheduled the pulling of the fiber optic cable for November 5, so we hope that will be done by the time you see this in the November Sirius Astronomer. This cable will replace the original backbone of the network with one that should be a lot more stable because it will be a lot less vulnerable to damage from lightning, and completing the cable run will put the wireless access point on the club observatory back in service. Once the new server is up and running and the new cable is in and connected, our full on-site wireless network should be back in service.

It will take a bit more work to get the Weathercam back on line – as I write this, the support structure is in pieces in my garage, and Charlie Oostdyk is working on getting us a replacement for the all-sky mirror and for the power cable. We need to repair the support structure and reassemble and weatherproof everything, then reinstall the whole assembly on Anza House before we'll be getting any Weathercam images on our website again. If the Weathercam isn't up and running by the time you see this and you'd like to help out with getting it refurbished and back in service, please do contact me about it!

Orange County Dark Sky Issues

Recently, several events have highlighted the need for action to preserve dark skies where they still exist in Orange County and have shown the need for serious action to improve matters in other areas of the county. Jack Sales, who has been very active in the International Dark Sky Association (usually referred to as IDA) and who was the IDA webmaster until fairly recently, called me about someone from Orange County who had contacted him for assistance – my conversation with him drove home the fact that our club could and should be a major player on lighting issues in Southern California. This was an area I was really hoping to spend more time on myself in the last year, and I'm sorry the time I'd hoped to spend on dark sky activities has had to go to other projects.

One issue in particular that has caused several people to contact the club for help is the Irvine Co. proposal to build around 4000 homes, a stadium and other facilities in Santiago Canyon. There were a couple days of hearings on the project before the Orange City Council in October, and two people did speak on the importance of preserving the night skies in that area, Carl Karenen and Anthony Mack. As currently proposed, this development would have a major impact on our Black Star Canyon observing site and on observing throughout the Santiago Canyon area, among other concerns.

OCA is fortunate to have a long-standing relationship with the Irvine Co., which allowed us access to our Silverado viewing site for many years, and which now, with the Nature Conservancy, allows us access to Black Star Canyon for our in-county star parties. Given the land values and the realities of conditions in Orange County, some development in Santiago Canyon is pretty much inevitable, but I'm hoping we may be able to work with the Irvine Co. to minimize the impact of whatever development is ultimately allowed on the night skies of the Santa Ana Mountains. Carl Karenen (one of the people who addressed the Orange City Council) is a past OCA member who has recently rejoined the club, and he's very knowledgeable on lighting issues. He's interested in becoming active in our Dark Sky group, and he's told me about contacts he's been making on his own with people within the Irvine Co., exploring ideas such as controlling the allowed types of outside lighting and when outside lights can be used through the CC&R's and other controlling documents for the development, use of night-friendly fixtures, and other measures that could potentially make this a model for night-friendly development. Although he's already done a lot in this area, Carl needs the help of other club members to improve the chances of success in this project.

The Irvine Co. is not the only developer whose projects could have a serious effect on the night sky in the Santa Ana Mountains. The Mission Viejo Co. has an even larger development planned north of the Ortega Highway near Caspers Park, and we need people to work with them, as well, to help make this development as night-friendly as possible. The easiest time to achieve this is in the early planning stages; once contracts go out to bid for fixtures, it becomes more costly for the developer to make changes. If you have any time you can devote to this issue, we need help developing contacts with the people in Mission Viejo Co. involved in decisions on lighting in their developments, and also help in educating them about lighting options and what they could and should do to help their projects use lighting more efficiently and in a more night-friendly way. The Sierra Club and other organizations have been working to minimize the impact of the planned development on other aspects of the environment, but lighting is not one of their major concerns even though excessive night lighting does have a significant effect on local wildlife, so there is a definite need for action from us to address these issues.

Even if you don't feel that you have the time or expertise to work with developers to improve the lighting in their proposed projects from the beginning, there are a lot of ways we can work as a club to improve lighting conditions in Orange County. As a first step, if you haven't joined our Dark Sky email group, please do – **OCADarkSky@yahoogroups.com**. If you aren't yet familiar with the IDA website, which is a tremendous resource for information about all aspects of dark sky issues, please check it out: **http://www.darksky.org/**. If there are dark sky issues that you are particularly interested in working on, I'd be very interested in hearing about them – and, if you're available to help out on various projects we undertake, I'll be delighted to add you to the list of potential volunteers. Next month I plan to write about some actions people can take as individuals as well as working with the group, and such things as where you can get good (and attractive) night-friendly fixtures – so please stay tuned! ■

TECHNICAL ASSISTANCE NEEDED FOR OUR WEBSITE

We need someone to handle the technical side of the OCA website. Hassi Norlen is our Website Editor, and deals with content and a lot of the day-to-day maintenance, but we need someone who can deal with the "down-and-dirty programming" aspects of the website. If you have knowledge of VBScript, JScript, Javascript, Access Databases, Microsoft IIS (Internet Information Server) and ASP (Active Server Pages), as well as HTML, and understand and are able to code dynamic web sites running under Microsoft IIS developed using ASP and Microsoft Access databases, you have the necessary skills for this, and we could really use your help.

If you can help us out with this, please contact Hassi Norlen (hassi@norlens.net or 714/710-9444) or Barbara Toy (btoy@cox.net or 714/606-1825).

NASA's Space Place

A Wrinkle in Space-Time

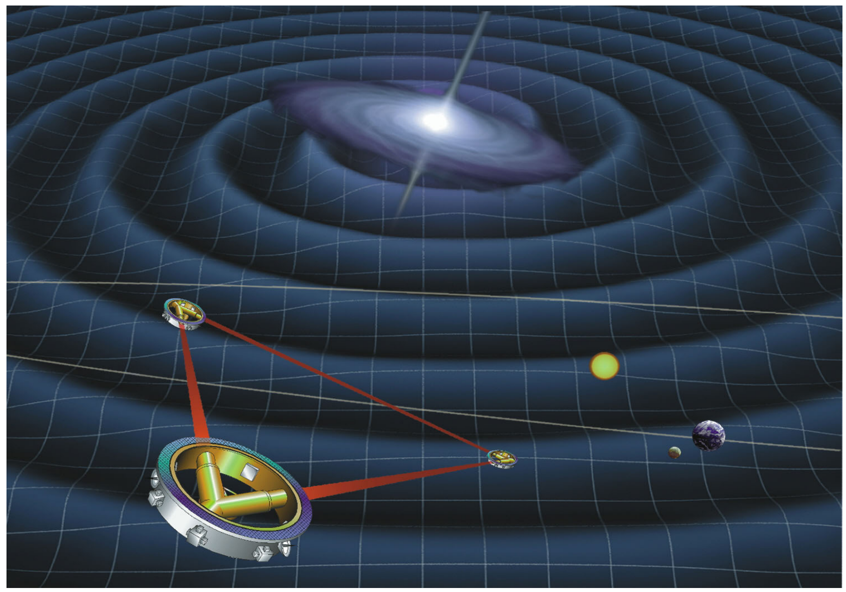
By Trudy E. Bell

When a massive star reaches the end of its life, it can explode into a supernova rivaling the brilliance of an entire galaxy. What's left of the star fades in weeks, but its outer layers expand through space as a turbulent cloud of gases. Astronomers see beautiful remnants from past supernovas all around the sky, one of the most famous being the Crab Nebula in Taurus.

When a star throws off nine-tenths of its mass in a supernova, however, it also throws off nine-tenths of its gravitational field.

Astronomers see the light from supernovas. Can they also somehow sense the sudden and dramatic change in the exploding star's *gravitational field*?

Yes, they believe they can. According to Einstein's general theory of relativity, changes in the star's gravitational field should propagate outward, just like light—indeed, at the speed of light. Those propagating changes would be a gravitational wave.



LISA's three spacecraft will be positioned at the corners of a triangle 5 million kilometers on a side and will be able to detect gravitational wave induced changes in their separation distance of as little as one billionth of a centimeter.

Einstein said what we feel as a gravitational field arises from the fact that huge masses curve space and time. The more massive an object, the more it bends the three dimensions of space and the fourth dimension of time. And if a massive object's gravitational field changes suddenly—say, when a star explodes—it should kink or wrinkle the very geometry of space-time. Moreover, that wrinkle should propagate outward like ripples radiating outward in a pond from a thrown stone.

The frequency and timing of gravitational waves should reveal what's happening deep inside a supernova, in contrast to light, which is radiated from the surface. Thus, gravitational waves allow astronomers to peer inside the universe's most violent events—like doctors peer at patients' internal organs using CAT scans. The technique is not limited to supernovas: colliding neutron stars, black holes and other exotic objects may be revealed, too.

NASA and the European Space Agency are now building prototype equipment for the first space experiment to measure gravitational waves: the Laser Interferometer Space Antenna, or LISA.

LISA will look for patterns of compression and stretching in space-time that signal the passage of a gravitational wave. Three small spacecraft will fly in a triangular formation behind the Earth, each beaming a laser at the other two, continuously measuring their mutual separation. Although the three 'craft will be 5 million kilometers apart, they will monitor their separation to one *billionth* of a centimeter, smaller than an atom's diameter, which is the kind of precision needed to sense these elusive waves.

LISA is slated for launch around 2015.

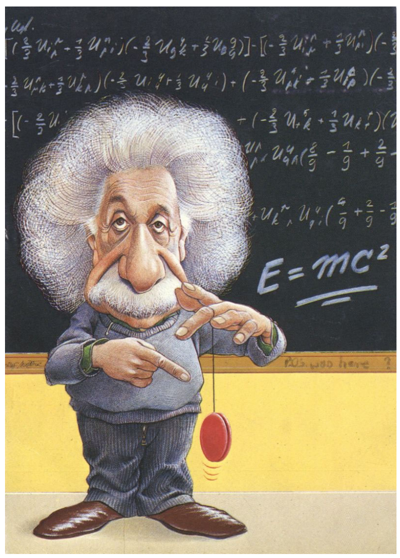
To learn more about LISA, go to http://lisa.jpl.nasa.gov. Kids can learn about LISA and do a gravitational wave interactive crossword at http://spaceplace.nasa.gov/en/kids/lisaxword/lisaxword.shtml.

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

Special Relativity

Explained by Don Lynn

The sound we hear with our ears is composed of waves traveling through air. In the late 1800s, many scientists believed, by analogy, the light we see is composed of waves traveling through ether. The problem was that no one could seem to detect the ether or its effects. Michelson and Morley realized that as the Earth revolves through the ether, it should affect what we measure the speed of light to be, so they did exactly that experiment. It was an abject failure as far as detecting ether, but it showed us that the speed of light is constant, regardless of motion of the observer. This constancy became the foundation of Special Relativity, later put forth by Einstein in 1905. Einstein actually came to this conclusion (constancy of light speed) by reasoning what would be observed while moving at the speed of light, not by considering Michelson and Morley's experiment. But happily for Einstein, but not for the competing theories' promoters, experimental proof already existed for Special Relativity.



Einstein did the math, that is, solved the equations of physics given the premise that the speed of light is constant, and the results were shocking. They violate what everyone has experienced, and what Isaac Newton had derived as the laws of physics. Specifically, if the observer and the observed are in motion relative to each other, the observer will see the mass, length and time change. The faster the motion compared to the speed of light, the more drastic the changes. Which explains why no one had discovered Relativity before – the changes at speeds that we are familiar with are too small to have any measurable effect. The motion has to be a substantial fraction of the speed of light before the changes in mass, length and time are large enough to be easily measured. On a really fast day in space (which hasn't happened since the Apollo missions to the Moon), an astronaut gets up to 1/27,000th the speed of light. That's not enough to notice the effects of Relativity. So there is no chance for Earth-bound mortals to notice.

Everything that relates to mass, length and time changes accordingly when they are in motion at a substantial fraction of the speed of light. This includes clocks, growth of living beings, radioactivity, speeds, acceleration and more. For example, if a baseball pitcher throws a ball at 100 miles per hour (forward) while standing on a train speeding at 100 miles per hour, then the observer on the ground measures the baseball at 200 miles per hour, simply the sum. Newton said so. Probably your math teacher back in school said so too. But if the baseball and the train were going fast enough that Relativity has a noticeable effect, then the speeds don't simply add up; the observer on the ground measures the baseball at considerably slower than 200 miles per hour.

Relativity says that at substantial speeds, time slows down, length grows shorter (only in the direction of motion) and mass increases. Any observer moving at a different speed sees a different amount of change. Time, length and mass are not the absolute quantities envisioned by Newton, but are relative to the motion of the observer. Hence, the name Relativity. The equations that describe this — how much change for what speed — have become known as the Lorentz equations, because the physicist Lorentz wrote them down, in fact before Relativity.

Before 1905, many scientists were hoping that the Lorentz equations were just a description of how ether in motion distorts our view of light. Einstein said the change was real. If a clock is put in motion fast enough for Relativity to affect it measurably, then you bring the clock back in front of you, motionless, it will have lost time. The clock doesn't gain back the lost time when you bring it back, as would happen if the time change were some kind of illusion or distortion of our observation. The changes in mass and length are real too, but harder to measure. You need an experiment that accumulates length (like a car odometer) to show the same effect as the clock, which accumulates time.

The clock experiment was difficult when Relativity was new, but is easy with today's technology. Atomic clocks measure time so accurately, even the tiny changes due to the speed of a jet plane are measurable. The GPS satellites that give you your position on Earth use the Lorentz equations to account for how slow their clocks are running because they are in orbit about the Earth, at a very tiny fraction of the speed of light. Particle accelerators at atomic labs around the world routinely shoot electrons and other particles at nearly the speed of light, so there the effects of Relativity are easily measurable. In fact the electrons speeding on their way through your TV picture tube, about to paint in light the image you see, are affected enough by Relativity that it has to be accounted for in the design of picture tubes.

What would happen if you reached or exceeded the speed of light? It won't happen, so fortunately I can duck answering. The Lorentz equations say that mass turns infinite at exactly the speed of light. What this really means is that it gets harder and harder to accelerate any material object as it gets closer and closer to the speed of light. So you can't apply enough energy to actually reach the speed of light, you can only get closer and closer. The result is that Einstein gave us the speed limit of the Universe, the speed of light.

In a separate paper, also in 1905, Einstein announced another astonishing result, again from doing the math. Mass is equivalent to energy. Some physical processes will convert one to the other. Conservation of energy and conservation of mass were widely believed as two separate laws of physics. But after Relativity, mass can sometimes leak away from that conservation by changing into energy, and vice versa. Einstein put it in an equation that eventually came to be represented as $E = m c^2$. Since c represents the speed of light, a very large number, a tiny bit of mass turns into a staggering amount of energy. This is what happens in atomic bombs, nuclear power plants, the Sun and every star: a little mass turns into vast energy.

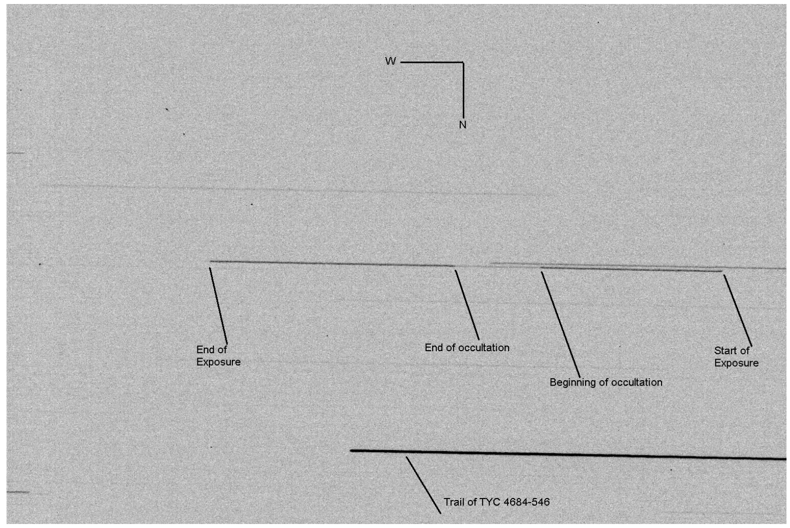
So why is it called Special Relativity? To distinguish it from Einstein's next astounding result, General Relativity, announced about a decade later. General Relativity explains how space and time change in the presence of gravity, a more general case than how they change with relative motion. But that's a future subject.

■

A Successful Asteroid Occultation

by Bob Buchheim

In the pre-dawn hours of August 30, 2005, the orbital path of asteroid (23) Thaliacarried it directly in front of the 11th magnitude star TYC 4684-1624. (An alternative way to think about this is that if the hypothetical occupants of a planet orbiting that star happened to be looking at Earth that morning, they'd have seen the silhouette of a small asteroid passing directly over southern California). Since the asteroid was about 1 magnitude fainter than the star, when the asteroid passed directly in front of the star (sort of a "stellar eclipse"), the star's brightness would drop abruptly.



Observing asteroid occultations is a tricky business, because of the multiple constraints: [1] the observer has to position him/herself within the occultation path (analogous to the path of totality of a total solar eclipse), that is only about 50 miles wide; [2] the observer has to be lucky enough that his/her chosen location turns out to be within the *actual* occultation path (which unfortunately may or may not match the *predicted* path); [3] the observer needs to find and identify the target star; [4] the observer needs to be monitoring the target at the right time (the time window is only a few minutes long); and [5] it is highly desirable to have equipment that enables the observer to record the observation.

The value of asteroid occultations makes it worthwhile to attempt to observe them: if multiple observers monitor the occultation from different locations, their results can be combined to determine the size and shape of the asteroid; and the timing of an occultation greatly improves our knowledge of its orbit. This is just about the only way to actually measure the asteroid's size (the other reliable way requires you to borrow a space ship from NASA).

I know of three ways to determine the time and duration of an asteroid occultation. First is the "eyeball and stopwatch" method: you visually monitor the target star, keeping a trembling finger on the stopwatch, and record the times of disappearance and reappearance of the target star. A third time split is taken at a precisely known time (e.g. from a WWV receiver). From these, you can determine the start time and duration of the occultation. The danger with this method lies in the variety of potential misfortunes: you may blink at the wrong time, or your finger may slip, or your reaction time may be slow due to cold or discomfort, or the occultation may have unusual features, and there's no permanent record to go back to.

Second is the "video camera" method: small, high-sensitivity video cameras are surprisingly inexpensive these days (SuperCircuits sells several models). You slide one of these into your telescope, and record the video of the target star for about 5 minutes on either side of the predicted occultation time, preferably recording WWV on the audio track. This provides a nice permanent record, so that you can carefully analyze the timing by re-playing the tape. The drawbacks that I've seen in this method are that the small FOV of the video camera makes it tough to confirm that you're actually watching the correct target star, and video sensitivity may not be sufficient for faint target stars.

For the (23) Thalia occultation I decided to try the third method of monitoring it: drift-scan. This approach was recommended to me by Dr. David Dunham of the IOTA (International Occultation Timing Association). I set up my CCD Imager and telescope to put the target star at the very eastern edge of the field-of-view. Then, about 30 seconds before the predicted occultation time, I turned off the telescope drive and started a 75-second exposure. The result is shown in the figure.

This turned out to be a really neat way to measure the occultation of a faint star: the CCD is quite sensitive, so the star's trail is clearly defined; there's a permanent record; most of the critical information is written automatically to the image's FITS header. The one important thing is to be sure that the exposure is set short enough that both ends of the star trail appear on the image. Then, it's a straightforward exercise in geometry to calculate the exact time and duration of the occultation. In the case of (23) Thalia, the occultation lasted 12.7 seconds. The asteroid's angular velocity was about 16 arc sec per hour, so this measurement represents a resolution of about 0.06 arc seconds – pretty amazing for an 11 inch scope!

The only unfortunate thing about this project was that I was apparently the only person in the whole world who saw it (at least, no one else reported data to the IOTA). With more observations, we could have learned the size and shape of this object (as it is, my result sets a lower bound on the size). I know that a few of you had planned to try for it, but were discouraged by the weather prediction (morning fog) and the time (about 4AM on a workday). Ah, well, perhaps next time.

I'll continue to post notices of asteroid occultations that are potentially visible from Orange County at the OCA Science SIG Yahoo Group. If you would like to learn more about the methods and value of observing asteroid occultations, I recommend the IOTA website (http://www.lunar-occultations.com/iota).

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Astronomy: Just a Hobby?

Or How I acquired GAS…….

by Alan Smallbone

Ever look back and remember when you first got interested in astronomy? That first time you remember gazing at the night sky in awe and wonder, maybe it was when you were a child or maybe when you were older, but that moment is a magical one that you will always remember. I remember my Dad sharing stories of the stars, trying to teach me the constellations and facts about our universe. He had an observatory when I was just a baby and I wish I could remember what those Southern Hemisphere skies of south-central Africa looked like, but I will have to wait until I can spend some time observing there or maybe in Australia sometime in the future. Sometimes the level of interest can dip as family and work take time away from observing only to be rekindled at some later time, and the wonder and magic again fill your imagination and pique your curiosity and you wander back into this hobby of ours. Times change but the wonders in the heavens are always there, night after night, reassuring and seemingly constant in these days of change. The one thing that has remained the same, we are all still trying to gather those far-traveling photons, whether they are bombarding and tarnishing silver halide crystals, collected and counted on sensors, or just plain pounding the backs of our eyeballs; it is all about observing!

So by now you are wondering what this has to do with GAS. I mean at one time or another we all get it, we all pass it on, whether or not we want to admit to it. Next time you are under the stars, look at your observing companions and notice if they have GAS, maybe a just a little or they might have a lot! By GAS, I, of course, mean Gear Acquisition Syndrome. What else could I be talking about? You were not thinking of something else were you? Shame, shame. Think about it, you have it, or have had it, and you definitely know someone with GAS. I know I see it all the time. GAS is always with us.

It may start out with just getting a better mount, or maybe you are really enjoying a faint fuzzie and suddenly you realize that if you have a little bigger aperture you might be able to see more detail, so there it is, a little GAS manifesting itself as aperture fever. Fever? Hardly, it is a full blown disease with little or no known cure, the only limits being spousal tolerance and/or bank account size. This week it's a 10-inch, next week it's a full blown 14-inch with your eye set on a 25-inch Dob for those nights when you do not want to set everything up, just point and look. And it does not stop with just aperture, with that larger aperture you need more eyepieces, better eyepieces, until you own various collections of Naglers and Radians and can discuss vintages of glass and "Panoptic" means something to you.

It doesn't stop there, noooooo, now the backyard has light pollution, so you need to get out to dark skies. You start planning vacations to areas with no lights, much to the dismay of the family, they just don't see the point in spending night after night in a desolate desert with no Starbucks for 150 miles and the only cell phone connection is the pay phone in the Sheriff's jail. Then it is vacations to see solar eclipses, meteor showers and the like; is there an end to this madness? Then the addiction really starts and now you must continue the observing into the daylight hours, that fiery orb in the sky is a prime target so it is H-alpha solar filter time, a "must" to check out those prominences and sunspots, and "CME" is now a familiar part of your vocabulary.

Now what? You have the mega-scope on the ultra portable mount with the super stabilizer and 27 eyepieces, each one a work of optical perfection. You have now counted and reaffirmed Messier's observations and wonder what took him so long; Herschel's observation list is no longer a dream, and you can split doubles with your eyes crossed, blind folded and spun around three times, using an eyepiece crafted from a toilet paper tube and a Cracker Jack magnifying lens.

Soon it consumes you, GAS is all around, your free time is spent searching the Internet for bargains and reading reviews on the forums. The Astromart Classifieds is your home page, you are on a first name basis with the moderators. Anacortes has your credit cards on file, as does OPT, Astronomics, and half a dozen other dealers. The Borg have assimilated you and Al Nagler calls you to have dinner when he is in town. The downward spiral has begun….

Now GAS takes over your life as you knew it. Your spouse and family members paw over Hubble images and ask you why you don't have any similar images. This is the final straw, the descent into the pit of doom. So now the old mount does not track to the sub pixel accuracy you need and things like guide scopes and photometry and astrophotography are muttered under your breath, you have that insatiable urge, more gear, more gear…. YOU NEED THIS GEAR… Soon your nights are spent huddled over red-lit screens of laptops, shivering in the dew and cold. Everyone else has long since retired and gone to sleep in their nice warm beds, while you are silently cursing that the seeing is now limiting your exposures. Cold is now your friend, heat your enemy; you see in monochrome and can tell the percent of light transmission by looking through the filters. You start to believe that if you blink fast enough you can make out the spectrums of the street lights and can decide on the best LPS filter to use. Madness or pixel peeping? Is there a difference? You now can do standard deviations in your head and dream of high signal to noise ratios, flat frames dance on your eyelids as you blink…. Madness takes it toll!…… When does it all end? Maybe never!

We have touched on how GAS can ravage your self, but how does it affect those around you? Well there is the obvious GAS envy, usually seen with aperture fever or sometimes sensor envy. It has been rumored that GAS can affect the world around you, have you not noticed that following a bout of GAS, there is often bad weather? Clouds, rain, hail, winds, fog, snow, you name it, we get it. The bigger the GAS release, the more the weather is tweaked! Too much of a coincidence to ignore! Why else would we keep our purchasing plans secret? The threat of bad weather is enough to bring the wrath of fellow observers or it just might be the desire to not let them be one up, I am not sure on this one. One thing is certain, GAS can also affect those around you.

So the bottom line is that there is no cure for GAS, we all get it, we all have it, we see it all around us. Sometimes we have a bad GAS attack and sometimes it is mild, but there is no reason not to pass the GAS on to your fellow astronomers, I am sure they will appreciate it, are we not taught to share? So what is the best recourse? Maybe one should just accept the fact of GAS and not be embarrassed, but take the bull by the horns and proudly step up to the plate and announce to the world: "I have GAS and I am proud of it!" Hmmm – isn't OPT having a sale this weekend……doh!

■

ASTROSPACE UPDATE

November 2005

Gathered by Don Lynn from NASA and other sources

To find out more on these topics, or those of past months' columns, through the World Wide Web, send your Web browser to our OCA Web site (http://www.ocastronomers.org), select Space Update Online, and the topics are there to click on.

Late Heavy Bombardment – It has long been known from studying the craters on the Moon and elsewhere that the inner planets suffered a relatively brief time of heavy collisions about 0.6 billion years after the time the planets formed (4.5 billion years ago). This has been termed the Late Heavy Bombardment (LHB). A new study of the relative numbers of asteroids of various sizes that exist now in the asteroid belt between Mars and Jupiter has found that the numbers match exactly the relative numbers of the various sizes of the objects that hit the Moon during the LHB. This proves that the LHB consisted of asteroids from the main asteroid belt, not comets as some astronomers had theorized. Also it proves that the colliders of the LHB were deflected from the main asteroid belt, without preferentially deflecting the larger or smaller asteroids. Populations of asteroids or comets other than the main belt ones, such as near-Earth asteroids, Trojan asteroids, Kuiper Belt Objects, or Oort cloud comets, do not have the same relative numbers of sizes of objects. This strongly supports that theory that the LHB occurred when Jupiter moved into an orbit closer to the Sun and gravitationally deflected large numbers of asteroids out of their usual orbits, many of them toward the inner planets. Recent evidence showed that Jupiter should have formed at a colder place than it is now, that is, in an orbit farther from the Sun. Now we know when Jupiter moved closer – the time of the LHB, 3.9 billion years ago. The result also shows that the numbers of various sizes of asteroids in the main belt have not changed substantially in the last 4 billion years. The study also included the Earth-crossing asteroids, and their numbers matched those of the objects that have created the Moon's craters that are newer than the LHB ones. Other consequences of this study are that 1) the technique of dating planetary surfaces from impact crater counts may have to be recalibrated, 2) the oceans on Earth probably vaporized during the LHB, and 3) theories of where the Earth's water came from will have to include less contribution from comets. The data for the study came from several recent sky surveys, including the Sloan Digital Sky Survey, Spacewatch, and a survey by the Subaru Telescope in Hawaii. This is the first time that accurate numbers and sizes of asteroids have been determined for both large and small asteroids. Previous searches were not sensitive enough to get good statistical samples of the smaller objects.

Deep Impact (comet collision mission) – More results from Deep Impact, from analysis of observations by 3 telescopes in Hawaii: 1) Material seen in this short-period comet (particularly ethane) match fairly well the material measured in Oort Cloud comets, so the composition of these two classes of comets is not as different as predicted. This supports theories that both classes originally formed between the orbits of Jupiter and Neptune and later moved elsewhere. 2) The total amount of mass ejected by the collision was about 1000 tons. This would require the comet to be made of softer material than theory, and this result agrees with other types of measurements already announced.

Cassini (Saturn mission) made its 8th flyby (of 45 planned) of Titan, taking radar images of a small area of the moon that showed what appears to be a shoreline separating a dark smooth area from a bright rough one. The patterns seem to indicate that the liquid (thought to be methane) receded from the shoreline, so the dark area may no longer be liquid filled. Like previous radar images, there are 2 types of drainage channels, ones that appear to be spring-fed streams, and ones that appear to drain rain (again, the liquid is probably methane, definitely not water).

Observations in infrared and radar of a **bright spot on Titan** near the feature named Xanadu have ruled out several possible explanations of the brightness, leaving only that it is different material there than anywhere else on that moon. Temperature measurements showed that the spot is not mountainous, and has no volcanic activity. Continued observations showed no movement, so it is not a cloud. Other bright spots on Titan do not appear the similar in all these wavelengths of light, so apparently have different causes for their brightness.

As reported in this column last month, NASA had announced that they were unsuccessful in attempting to image with Cassini the "**spoke**" features seen in Saturn's rings by Voyager. A few days later, after the Sirius Astronomer went to press, NASA released Cassini images of the spokes. "If at first you don't succeed, try, try again." They are fainter than seen before, but they are in the right place moving at the right speed, so are definitely the spokes. Possibly they will grow more distinct as the Sun angle on the rings changes with Saturn's seasons. Since the Voyager images, it has been known that the spokes rotate at the speed of Saturn's rotation, not at the speed of the rings' rotations. Most astronomers now believe that this could happen only if the spokes are following Saturn's magnetic field, but exactly how this happens is not entirely understood.

Cassini performed its closest flybys of Saturn's moons Tethys and **Hyperion**. The latter looked like no other space object we have ever seen, having an appearance best described as resembling a sponge. Many of its craters have layers of dark material at the bottom. The layer is apparently not thick, since at least one crater punched through to lighter material underneath. Scientists are curious about what the dark layer is. Unfortunately, this is the only close encounter with Hyperion that will occur in Cassini's 4-year mission. Images of **Tethys** showed an icy land of steep cliffs and craters. The area of Tethys imaged was near its south pole, where no Voyager images were taken. The 2 Voyagers are the only previous spacecraft to image Saturn's moons. Close ups were obtained of a giant rift called Ithaca Chasma. It and its surroundings are covered by impact craters, implying the surface in that area was created very long ago (the more craters, the longer since it was formed).

Short gamma-ray bursts – A team of astronomers has for the first time observed the visible light afterglow from a short (less than 2 seconds) gamma-ray burst (GRB). It is only the second short GRB to have its afterglow seen in any form of light. The other one, reported here in June, was seen afterglowing only in X-rays. Its observation fit with the theory that short gamma-ray bursts are caused by colliding and merging black holes or neutron stars. The new observations provided even stronger evidence of this. The new observations are best fit by a neutron star merging with a black hole, because of the timing of the X-rays with respect to the gamma rays. Long (over 2 seconds) gamma-ray bursts are almost certainly caused by hypernovas (supernova explosion of a very massive star). The evidence for this came only 2 years ago, though GRBs have been observed for over 30 years. The more recent short GRB was located on the outskirts of a star-forming dwarf galaxy about 2.4 billion light-years away. It was observed also in X-rays and other wavelengths of light. Observations made for 20 days after the burst would have seen, but did not, any hypernova at this distance. The earlier observed short GRB was located on the outskirts of a non-star-forming elliptical galaxy 2.7 billion light-years away. Both of these locations should have many close binary neutron stars, but should not have massive stars that might undergo hypernovas. The frequency of short gamma-ray bursts, and this evidence that they are caused by merging neutron stars, are good news for scientists trying to detect gravity waves. A merging of neutron stars somewhat closer to us than these 2 short GRBs should produce gravity waves strong enough to detect with current technology gravity wave detectors.

Transiting exoplanet – A European planet hunting team announced the discovery of the 9th planet to cross in front of (transit) its star, a magnitude 7.7 star in Vulpecula, near the Dumbbell Nebula. It is the largest planet known relative to its star, so it covers the most light, causing a 3% drop in brightness. That much change in a star that bright is easily detectable by amateur equipment. Professionals expect to be able to measure the effects of the planet's atmosphere on starlight, and so determine the atmospheric temperature and possibly composition. Also starspots should be measurable when the planet covers them. Features already measured are: planet mass of 1.15 times Jupiter's, diameter 1.26 times Jupiter's, orbit period 2.219 Earth days, distance from its star of 0.0313 times Earth's distance from the Sun, density of 0.75 (near Saturn's density). Theoretically a planet this close to its star should be several hundred degrees, though the temperature has not been measured yet. The size is larger than predicted by theory for this mass and estimated temperature. One other transiting planet that has had its diameter measured is also larger than theory.

Shuttle replacement – NASA released plans for the crew vehicle and launch rockets that will replace the Space Shuttle as our country's means of sending people into space. The crew vehicle will be an expanded and modernized version of the Apollo capsule, with space to hold up to six passengers. It will be designed for trips to the Moon or Mars or visits to the Space Station, including uncrewed supply trips. It is planned to be reusable for about 10 missions. An abort rocket to remove it from the rest of the rocket in case of emergency is included in the design. It will fly on top of its launch rocket, not to the side like the Shuttle, to eliminate the possibility of debris from the rocket damaging the capsule. The crew vehicle is planned to be ready as early as 2010, so that it can replace the Shuttle that year for trips to the Space Station. The launch rocket for it will use as its first stage a larger version of the Shuttle's solid boosters. A new rocket using 5 of the same liquid hydrogen fueled engines used on the Shuttle, and 2 larger solid boosters, will be used to lift heavy cargo into Earth orbit or to the Moon, and could be used for heavy crewed missions also. The reuse of existing parts and designs was chosen for safety, cost, and schedule. A service module and a lunar lander will also be developed. The lander will be much larger than the Apollo one, allowing crews of 4 to land, with supplies for up to a week on the Moon. Liquid methane will power the lander's rockets, so that a similar vehicle used to land on Mars could be refueled with harvested methane from Mars. Before the Moon landings, robotic lunar missions during the years 2008 – 2011 will study and map the surface to help select landing sites and determine if resources, such as oxygen, hydrogen and metals, are available. Initially (about 2018) one week landings would be scheduled about twice a year, followed by longer-term stays requiring supplies and infrastructure to be landed separately.

Hubble Space Telescope (HST) has used its spectrograph to identify the source of a blue glow near the center of the Andromeda Galaxy, first seen 10 years ago. It is a disk only a light-year across consisting of more than 400 stars formed in a burst of activity about 200 million years ago. They are furiously speeding (2.2 million mph) in orbit about the super massive black hole at the core of the galaxy. The disk is nested inside a ring of older, redder stars previously known. Astronomers were perplexed about how the blue disk of stars could form there, since the black hole's tidal forces should break up star formation processes. The center of our own Milky Way galaxy also has a bunch of bright young stars near its black hole, so the theorists really needed to rework this (see the 2nd Chandra item below). The new HST data incidentally gave ironclad evidence that only a super massive black hole could explain what is going on in the center of the Andromeda Galaxy. There was already excellent evidence of this, but this data absolutely ruled out any other theories.

HST along with the Spitzer (infrared) Space Telescope has measured the mass of the stars in several very distant galaxies, which we are seeing as they were far in the past, when the light left them. One galaxy, designated HUDF-JD2, was a more mature and **massive galaxy** than theory says galaxies should be that early in the history of the Universe. It developed 8 times the star mass of our Milky Way in a few hundred million years after the Big Bang, then suddenly stopped forming new stars. The galaxy was found in the HST infrared ultra deep field (UDF) image, but was not seen in the visible light UDF image of the same area. It is believed that intervening gas absorbed the visible light. Other galaxies found in the UDF images at this distance, and therefore at this early time, were all small and not yet fully developed. The conclusion from this is that most galaxies were built up slowly from merging of smaller galaxies, as current theory says, but there were a few exceptions. More theoretical work is needed to explain those exceptions. Images of HUDF-JD2 were later made in near infrared by the VLT telescope in Chile and by the Spitzer, using longer wavelength infrared. At the longer wavelength, the galaxy is surprisingly bright.

Early star formation – A survey of 8000 galaxies done with the multi-object spectrograph on one of the 4 VLT 8-meter telescopes in Chile has found that a large portion of the galaxies have bright vigorous star formation. The galaxies studied were so distant that the light left there between 9 and 12 billion years ago. So the survey saw galaxies as they existed when the Universe was 10% to 30% of its current age. This survey's percentage of galaxies with vigorous star formation is 2 to 6 times higher than previous studies of galaxies during this time period. It is believed that the inability to take large numbers of spectra of really dim galaxies by any previous instrument prevented all previous studies from getting representative samples of galaxies. The multi-object spectrograph can take spectra of up to 1000 galaxies simultaneously for ones as dim as magnitude 24. The new measurement says that new stars formed at a much higher rate than previously thought during this time in the history of the Universe. Theories and computer models of galaxy formation and evolution will have to be adjusted to take this into account.

Very young star – It took observations by the Spitzer (infrared) Space Telescope, the MMT telescope in Arizona, and the

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Submillimeter Array (SMA) in Hawaii to find and identify an object hidden in a dust cloud. It turned out to be a star so young (between 10,000 and 100,000 years old) that it is still forming. It has about 25 times the mass of Jupiter now, which classifies it as a brown dwarf star, but is still gaining mass, so may grow into a full fledged star. It is shining with about 1/20 the brightness of the Sun, and is throwing a weak outward flow of material, as predicted by star formation theory. It took the MMT observations to show that the object was embedded in the nebula, rather than a background object, and it took the SMA observations to find the outflow and measure the mass. This shows how some discoveries require observations in multiple wavelengths (types) of light.

Chandra (X-ray space telescope) has imaged the remnant of Tycho's supernova, which exploded in 1572, and found that the shock wave was not leading the debris sphere by the amount predicted by theory. It should have been 2 light-years outside, but was only a half light-year. The most likely explanation is that the shock wave has been slowed by transferring of some of its energy to atomic nuclei in interstellar space. That amount of energy should result in accelerating the nuclei to speeds usually seen only in cosmic rays. Scientists have been trying for about a century to explain how cosmic rays (charged particles traveling very close to the speed of light) can be made to move so fast. Proposed explanations include flares on stars, pulsars, black hole accretion disks and supernova shock waves. The Chandra observations strengthen the case for that last explanation.

Chandra observations revealed a new generation of stars caused by the conditions about the super massive black hole at the **center of the Milky Way**. The gravity of a massive disk of gas about the black hole offsets the tidal forces of the black hole, which had previously been thought to disrupt star formation near any super massive black hole. It was already known that stars existed in this area at the center of our Milky Way, and it had been thought that they must have migrated there after forming elsewhere. However, the new Chandra observations do not match the numbers and masses of stars that a migration should produce. They do match the numbers and masses theoretically produced if the disk's gravity offsets the black hole tidal forces. The numbers of stars near the center of our galaxy had not been accurately measured at wavelengths of light other than X-rays, because only X-rays penetrate the gas and dust in this area.

Planet formation – Of the thousands of meteorites known, 45 of them are somewhat older than the planets. A study of about half of these showed that all the material in them is depleted in elements that can be vaporized by moderate heat (termed volatile elements). All the inner planets have long been known to be so depleted, but until now it was not known if this occurred before, during, or after the formation of these planets. It must have happened before in order to have affected these meteorites. Probably this means that driving off of the volatile elements occurs early in the formation of any planetary system. Without this volatile depletion, Mars and Earth could have ended up as gas giants like Neptune.

"Tenth" planet's moon – The object newly discovered in the far reaches of our solar system, which may be the tenth planet, pending a definition of a planet by the International Astronomical Union, has a moon orbiting it. The discoverer of the possibly tenth planet, astronomer Mike Brown, also found the moon. It was spotted in images he took with the Keck II 10-meter telescope in Hawaii, using its laser guided adaptive optics system. Brown has nicknamed the "planet" Xena, until a permanent name is established, and he is now calling the moon Gabrielle, after Xena's sidekick in the TV show. It orbits in about 2 weeks, and is about 5 magnitudes dimmer than Xena. The latest estimate of the diameter of Xena is about 1700 miles, and Gabrielle is roughly 150 miles. Further observations are planned with the HST to pin down the orbit of the moon precisely, which will allow calculating the mass of Xena. Brown also found a moon orbiting one of the 2 other large distant Kuiper Belt objects that he imaged. Finding moons orbiting 2 of 3 such objects implies that the current theory of how Kuiper Belt objects get moons is wrong. That theory holds that such moons are gravitationally captured, but statistically that could happen to only a small percentage of Kuiper Belt objects. Quite likely this will have to be replaced by a theory involving impacts that break off pieces which become moons.

Mars Global Surveyor (MGS) – After 8 years in orbit MGS has found quite a few changes that occurred in the surface of the red planet, including new gullies in sand dunes, boulders tumbling down slopes, new impact craters, and shrinkage of the south polar dry ice cap. Although the original mission was to end 4 years ago, the spacecraft is still healthy and may last 5 to 10 more years. Counting the number of craters that are new since the earliest detailed images of Mars about 30 years ago, the rate of collision appears perhaps 5 times smaller than theoretical estimates. This suggests that the technique of dating planetary surfaces from impact crater counts may have to be recalibrated (second time you've read that).

Spitzer (infrared space telescope) has imaged the entire Andromeda Galaxy, piece by piece, since it is far larger than the field of view of the telescope. The result is a mosaic made of 11,000 separate images. A number of features are shown in infrared that were not known before: an off-center ring of star formation, a hole where a satellite galaxy apparently punched through, and a spiral quite close to the center.

Instant AstroSpace Updates:
Observation of Pluto's moon **Charon** occulting (passing in front of) a star in July has resulted in a very accurate determination of its diameter (749 miles) and density (1.73). These can be used to refine the size and density of Pluto itself.

The Hubble Space Telescope has imaged **Pluto** in color showing dark areas thought to be dirty water ice, brighter ones indicating nitrogen frost, and reddish ones indicating methane ice or possibly other carbon compounds. An unusual bright spot is thought to be carbon monoxide ice.

The **youngest** (about 100,000 years old) **massive binary star** yet seen has been imaged by the UKIRT infrared telescope in Hawaii. Young stars are difficult to image because they are hidden in the thick layers of dust out of which they formed.

China launched its 2nd manned spacecraft, this time with 2 astronauts aboard on a 5-day mission. 2 years ago, China became the 3rd country to launch people into space.

Gravity Probe B, designed to measure the Relativistic warp of space by the Earth's gravity and the twisting of space by Earth's rotation, has completed collecting its data during the 17 months it has been in orbit. Data analysis is expected to take a year.

Mars Express (European Mars orbiter) has had its mission extended for another Martian year (nearly 2 Earth years), as it was scheduled to end next month. This will allow continuation of its highly successful high-resolution color stereo mapping and its radar studies of the atmosphere, surface and subsurface.

Ulysses (European solar polar mission) celebrated 15 years in orbit about the Sun and is still returning data from areas visited by no other spacecraft. Its mission has been extended for 3 more years.

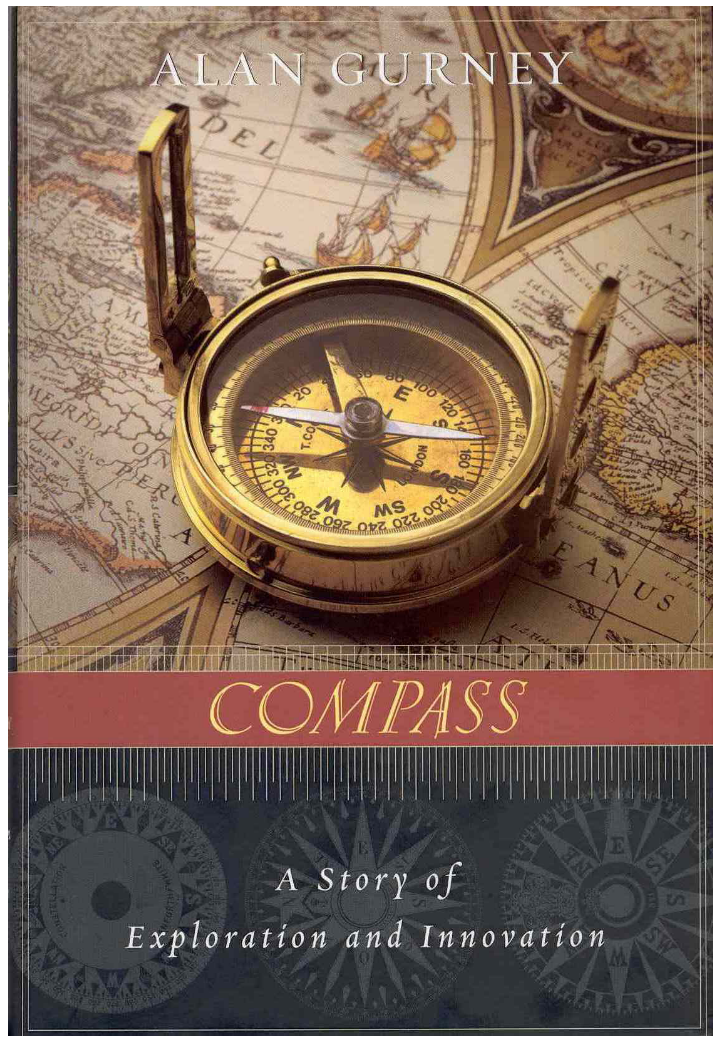
The European Space Agency has narrowed its candidates to the asteroids 2002 AT4 and 1989 ML as targets for their asteroid impact mission named **Don Quijote**. An observer spacecraft will watch the impact and determine how much the asteroid's orbit is changed.

The Dunn solar telescope at Sunspot, New Mexico, has begun operation of **adaptive optics** to counter twinkling from our atmosphere, and has produced extremely fine resolution (1/7 arc second) images of solar features, including sunspots. There are hints already of new features to be discovered in solar activity.

Book Review

by Barbara Toy

You may have noticed that we've been running more book reviews in recent months – this came from a request we received for more book reviews, to help people learn about books they might like to read. Gordon Pattison provided the kick-off review that appeared in the June issue, and has sent additional reviews since, for which we sincerely thank him. For all of you out there who are reading books that you find informative, entertaining or just generally interesting on anything related even remotely to our hobby, please take note – your fellow members *do* want to know what you think about them and whether you'd recommend them. So please send in your reviews – you can cover what the book's about, what you liked or found particularly valuable about it, how it compares with other books on the same topics you might be familiar with, even any criticisms you have (but please keep them polite).



To help keep this feature going, here's this month's review:

***Compass* by Alan Gurney, 2004, W.W. Norton & Co.:** This is a history of the development of that mainstay of navigation, the compass, but it reads more like a novel than a scholarly treatise, with the emphasis on problems found with compasses of different designs over the years and the people who tried to solve them. It introduces many interesting characters, some at length (such as Matthew Flinders, who took about 2500 readings while charting the coasts of Australia and neighboring islands, and who, in the years he spent as a French captive, used his readings to analyze magnetic deviation, particularly the effects of the attraction of the metal in the ship itself on its steering compass), and some mere vignettes (such as Robert Norman, a sailor turned instrument-maker who was the first to seriously investigate the "dipping" of a compass needle in the late 1500's, and William Barlowe, a minister who had a love for the sea and sailors, who, in the early 1600's, designed the first azimuth compass with sights and a verge ring marked in degrees that remained in use for over 200 years).

There's a strong tie between astronomy and navigation that goes back many centuries, so it's not surprising that a number of astronomers contribute to the story. Of particular interest are the chapters devoted to Edmond Halley and his contributions in astronomy and navigation – we meet him walking along the bottom of the English Channel in 1691 in a dive suit of his own design, and, among other things, learn later that we have him to thank for the convention of connecting points on a chart or map that have the same readings with the curving lines that are now used to produce contour maps of terrain and weather maps showing pressures or temperatures – Halley used the technique to show points with the same magnetic variation.

The book is well-written, entertaining and informative. My main quibble with it is that the author does very little to explain the phenomena he describes in terms of the current understanding of magnetism and the earth's magnetic field – but maybe he felt that was beyond the scope of his book.

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