GNTO News and Views

The most recent GNTO event was our training session on July 17, when we had 10 to 20 people take advantage of Level 1 training and our third Constellation Tour. The general sky tour was lead by Karen Keese while Larry Cash did the detailed single constellation tour focused on Scorpius. Dale Murray led the instruction session on Level 1 training. We had 8 to 10 telescopes set up on the observing field and somewhere between 35 and 40 people for our total attendance. Sky conditions were fairly good, and everyone had a great time.

Our GNTO committee meeting took place on July 22 with Ray Collins, Dee Friesen, Dale Murray, Gordon Pogue, Shane and Becky Ramotowski and Pete Eschman attending. Larry Cash was able to join us for the post meeting discussion. New maintenance items included the main dome flooring, and a discussion of the problem of Twining Lane maintenance. We plan to check on the legal status of Twining Lane, and to see if we can get the county to grade the road. Another option is to get a private party to grade the road for us. Dee Friesen and Micky Bock have volunteered to take on the task of refurbishing the seats in the guest trailer will be reimbursed for any related expenses. Dale volunteered to do some weeding at GNTO, so we thank him for helping to counteract the weed invasion that has been triggered by recent rains.

We have completed a grant application to Intel, and we are waiting to see if our funding request is approved. We have received our first commercial order for 150 copies of TAAS Deep Sky Southwest screen saver. We just had a favorable review of this product in the September issue of Sky and Telescope (p. 110) and dedicated readers may recall that we had a good review in Astronomy magazine in their May issue (p. 90). Our thanks go to Karen Keese, for getting the materials sent out for these reviews. I think it is remarkable that TAAS is getting national press for our project, and I'd like to thank everyone that worked so hard to produce such a great product.

Barry Splezer has completed the new motor mounts for the Isengard drive system. A big thanks goes to Barry for his efforts to engineer, machine parts and implement these custom modifications. On July 30, Dale and I tested the motor system with great results. We confirmed good tracking, and did the first electronic goto on the Isengard. The new system is a SkyWalker 1i from Astrometric Instruments. It features heavy-duty servomotors, which are controlled from a convenient hand pad. When connected to our GNTO laptop, the SkyGuide software can be used to sync the telescope to the sky and goto a variety of objects. The goto system can also be controlled from planetarium software, such as Cartes du Ciel and TheSky. We plan to have the new system operate in parallel with the NGCMAX as well as the manual setting circles, so that the telescope can be used in a variety of ways. In the near future, the manufacturer will send us a smart hand pad, which will have built-in goto capability, so we will not be dependent on a computer.

This wonderful new system was made possible by a series of donations that came to GNTO by way of honoring Lyman Sandy, a long time TAAS member and GNTO supporter. We plan to have a dedication of the new drive system at our Equinox Picnic and Training Session on September 18. Please plan to attend.

Our next scheduled event at GNTO will be our "New Moon" opportunity on September 11. As part of our event, we will offer our fourth Constellation Tour. This tour is designed with beginners in mind, and will feature a two-part introduction to the summer night sky. Part One covers a number of ways to navigate around the night sky and gain familiarity with celestial objects. Part One will deal mainly with stars and other objects that are visible to the naked eye. Part Two will focus on a particular constellation...
President's Message

It is hard to believe that summer is almost gone. The Perseids have come and gone, Cygnus is flying high overhead and soon Orion will be rising earlier in the evening. There is only one more Oak Flat Star Party this year and the school supplies are in the stores. This all means that soon it will be time for the School Star Parties. We start this year’s school season with a bit of disarray. Our Education Outreach Chairman has stepped down after two exhausting years doing more that many of us thought possible. Sammy Lockwood left some mighty big shoes to fill. Not only did he serve the last two years as the Chairman but served on the Education Outreach committee before that. Whenever you see Sammy at any of the TAAS events please give him a big thank you for all the work he performed in making the past several years of Education Outreach highly successful.

So where do we go from here? Well, we will go onward of course. We have a schedule of parties for the coming months and we have a committee to arrange things and we always have a number of willing docents to get out there and show those kids the splendor of the night sky. Without Sammy’s stewardship we all who participate in education outreach will have to pitch in a bit more to make things happen until we find a new Chairperson, but those kids are waiting for us and we will not let them down.

On a humorous note, while writing this article my spell checkers has been objecting to Lockwood and instead is suggesting “Locoweed”. I guess it thinks Sammy has to be a little loco to have worked so hard for so long. My personal thanks. Sammy, hope to see you soon.

My article is a little short this month (hold down the applause!). I waited until the last moment because I had some work travel for the first part of the week and now I am nearly late to head out to a GNTO work session. Tonight Pete and I will permanently install the new drive system. After tonight the Isenguard will once again track properly. It will not only track and can be used in the same way as before but will also have a controller pad to allow the scope to be motor driven to positions and allow slow motion fine adjustments from the eyepiece. Soon we will install new encoders that will then allow the scope to be used in the full “go-to” mode. This will require new training to use the scope in this way but not to worry; it can still be used in the manual mode in much the same way as before. I know that I am anxiously awaiting the final product, seeing a scope of this size move on its own to point at some jewel in the sky is a sight to behold.

Heather Mann

TAAS General Meeting News

July 3rd General Meeting

I have always loved the night sky. When I was a child, my father would take me out into a wheat field in Northern Idaho and show me the many bright objects, telling me about the vastness of the universe. I treasured my time with him on those balmy summer nights in August when it seemed that I had both him and the universe all to myself. We never talked about the science behind the formation of the universe and my father couldn’t answer my questions about how stars formed, but I remember that my love of observing found its beginning there.

I have been a member of TAAS for two years now, and have learned a great deal through the club meetings; however, I found the TAAS general meeting on July 3rd to be fascinating. Members of the club ate TAAS secret recipe stellar popcorn and watched a video hosted by Alan Alda of old “MASH” television yore. Alda lead the club members on an exploration of the question, “is the universe expanding or contracting?”

The theory, as I learned, is that there is matter in the universe that we can see, matter that we cannot see, and a hidden force that is pushing us all apart. Even more interesting is that “dark matter” is probably 6 times more common than the everyday matter we associate ourselves with. While as if to not be outdone, “dark energy” then appears to reign supreme over the other two forms by tipping the scales of our universe’s mass-energy balance. The result of all this is that not only is the universe expanding, it appears to be expanding!

I’ve thought more about the expansion of the universe since the July general meeting and have felt an even greater appreciation of the complexity and wonder of our reality. Last night, I found myself back in Northern Idaho. This time, I stood with my eight year old nephew who, amidst the Perseids, saw his first shooting stars, learned the difference between an airplane and a satellite, and located the big dipper. The pure joy in his smile as he jumped up and down in the field and the sparkle in his eyes taught me that, while I know more now than I thought I did about the mechanics of the night sky, there is still no substitute for the magic of a wheat field, someone you love, and a dark expanse of clear sky on a balmy August night.

The Official Newsletter of The Albuquerque Astronomical Society
and any good telescope objects found within it.

The Tour includes a complimentary map handout for the featured constellation, which participants can use to locate and observe the objects discussed. Several telescopes are available at GNTO for use by constellation “tourists.” Karen Keese will present Part One, and Part Two will be held in the Ortega building immediately following Part One, and will be taught by Larry Cash. The first part of the tour will begin at dusk, around 8:00 P.M.

We will also be at GNTO the following weekend for our Equinox Picnic and Training Session on September 18. This event starts with a GNTO open house, followed by a potluck picnic and later training sessions. This is a popular event, and is a great time to visit GNTO for the first time, or to check to see what is new. As I indicated earlier, we will have a dedication of the new Isengard drive system, so you will not want to miss this occasion.

The open house will start around 4:00 P.M., followed by a picnic potluck diner at 5:30 P.M. The barbecue grill will be available for those who want to cook, but we will be using it first to prepare the hotdogs and hamburgers that will be provided. Please mark this on your calendar, and plan to bring a dish to share. More details will be forthcoming in future email notices and at our next general meeting on August 28th.

For the training part of this event, we will offer Level 1 instruction on the use of the Isengard 16” reflector and the two loaner scopes at GNTO. This will be a great time to check out the new drive system on the Isengard. Our GNTO loaner scopes include 6” and 16” reflector telescopes on easy to use dobsonian mounts. Level 1 training will commence at 6:45 P.M. and sunset follows at 7:08 P.M. The Level 2 training, which covers computers use and astronomy-related software, will occur after Level 1 training is finished. As I noted earlier, we will have the constellation tour on the previous weekend, rather than at this event. We are looking for an opportunity to re-start our Level 3, CCD imaging training program, and I hope to have an update for that, included in an email notification in September. If you are thinking about coming down to GNTO, please remember that our two loaner scopes are on easy to use dobsonian mounts, and our Isengard 16” is providing some really great views these days. With all this great equipment at our facility, you do not need have your own equipment to enjoy GNTO. The comfortable Ortega Building is available for socializing and our Guest Trailer is available for coffee, hot chocolate and any snacks you want to share.

GNTO committee meetings are open to any interested TAAS member and they are a great way to get a bit more involved with your observatory. We need your help. Our next scheduled meetings are on August 19 and September 23. We meet at 6:30 P.M. at the Village Inn restaurant on San Mateo just north of Academy. If you have questions about access and availability of GNTO, please contact me (Peter Eschman, gnto@taas.org, home phone: 873-1517).

I hope to see you soon at your observatory.

pictures at an exhibition

Karen Keese

Join us on Saturday, October 2 at 7:00 P.M. for the TAAS general meeting, the awards ceremony for the third annual “Astro-Images of New Mexico: Portraits from the Foothills of Space” photo contest, and the opening of the uniquely New Mexican photo exhibition. This extravaganza will be held in the LodeStar planetarium, located in the Museum of Natural History on Mountain Road in Old Town. Free parking is available.

The photo contest committee--David Blair, Neil Goldberg, David Beining and Karen Keese--has worked very hard to ensure that this will be the best contest and exhibition yet. Many thanks to our tireless panel of judges for lending their expertise again this year: Laurel Ladwig, Kirk Gittings, Gordon Pegue, John Fleck, and David Blair.

TAAS and LodeStar gratefully acknowledge this year’s corporate sponsors: APT Camera Repair, Camera & Darkroom, Forms Plus, Kurt’s Camera Corral, and TJ’s Camera & 1 Hour Photo. Please patronize these fine establishments and let them know that you support them because they support our contest and exhibition! Special thanks go to Sandie Koson, development officer for LodeStar, who is our hard-working liaison with our sponsors.

Neil Goldberg has once again secured a great speaker for the evening’s lecture. So come while away a few enjoyable hours with friends, feed your mind with a satisfying astronomy lecture, and feast your eyes on the startling range of beauty to be found in our own New Mexico skies.

“Thor and Cassiopeia”
image by Randall Roberts of Carlsbad

Best of Show 2003

The Official Newsletter of The Albuquerque Astronomical Society
# September 2004

## Calendar

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## Get Your Events Put on Next Year's Calendar

It's time to assemble the TAAS calendar for 2005-2006. Submissions are welcome. Maybe you think we should commemorate Newton's birthday, Earth's passage through aphelion, or the founding of TAAS.

Whatever it is, if you have any events/dates that you would like considered for inclusion in the calendar please e-mail them to Neil Goldberg at joaneil@earthlink.net. Thanks and Clear skies,

Neil M. Goldberg
Events Coordinator
## October 2004

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### ATMA Workshop

**Ray Collins/Mike Pendley**  
**atm@taas.org**

The Amateur Telescope Making Workshop meets the first and third Wednesdays of each month at Valley High School, 1505 Candelaria—the north side of Candelaria, just west of 12th street. The meetings begin at 7 P.M. and are in Building E, Room #3.

### TAAS General Meeting

**Saturday, August 28, 2004**

**7:00 P.M.**

**Regener Hall - UNM Campus**

**Subject**

To Be Announced

**Speaker**

To Be Announced

**Notes**


GNTO = General Nathan Twining.

GNTO Training = GNTO Observing and Training.

UNM = University of New Mexico Observatory. Call the TAAS hotline @254-8227, or the UNM hotline @ 277-1446 to confirm, or unm_coordinator@taas.org.

ACSA = Albuquerque Coffee Shop Astronomers. Contact Sammy Lockwood for information or visit www.taas.org and select sidewalk astronomy.

ATM = Amateur Telescope Making. Call Michael Pendley for information @ 296-0549, or atm@taas.org.

P & A = UNM Physics and Astronomy. Corner of Lomas and Yale.

= School Star Party.
Welcome to New TAAS Members

Jewel Karpel
Tom & Lou Krajci
Gareth Jones

Donations to TAAS

TAAS General: Sidney Stone
GNTO: Sidney Stone
Education: Sidney Stone
Dark Sky: Melissa & Whitson Kirk Ill,
Thomas & Cheryl Graham

Enchanted Skies Star Party
Gets Bigger and Better

The Enchanted Skies Star Party, acclaimed for its excellent dark skies and outstanding daytime programs for the past decade, is expanding to a five-day schedule for 2004 to make room for new, hands-on workshops and a full night of observing above 10,000 feet elevation.

The Socorro, New Mexico, event scheduled for October 5-9, 2004, also offers special club and school group rates allowing attendees to save 33 percent on registration. The new, Tuesday-through-Saturday schedule features a series of hands-on workshops on CCD imaging; using the powerful The Sky package of astronomical software; and bringing astronomy to your community through educational outreach. The educational outreach workshop will be presented by the Astronomical Society of the Pacific. For more information on the Eleventh Annual Enchanted Skies Star Party, see the Web site at: http://www.socorro-nm.com/starparty

Barry Spletzer has agreed to become the new TAAS webmaster. Barry’s hard work and dedication to this club is legendary. Thank you Barry once again for your tireless efforts.

Sammy Lockwood

Please note that the deadline for the October 2004 issue of the Sidereal Times will be Friday, September 17th, as the finished manuscript must be at the bulk-mailer before Monday, September 20th, so that you will receive it by e-mail that day or by s-nail mail the following Saturday. My e-mail address is Barry Spletzer has agreed to become the new TAAS webmaster. Barry’s hard work and dedication to this club is legendary. Thank you Barry once again for your tireless efforts.

Jay Harden, UNM Campus Observatory Coordinator

Brock Parker

Jay is out of town, so I’ve temporarily inherited the report.

9 July: Dale and I sat under the clouds until about 9:30 with no visitors. 16 July: Good clear night, However only two visitors took advantage. Docents: Dale & Brock, Mickey, Judy, & Jim Brockway lent moral support.

24 July: The Monsoon got us. It was raining at dusk, so I didn’t bother to go down. I later heard that a few folks turned up.

30 July: Started out as a fine night, but clouds moved in late. In spite of the construction to the parking lot entrance, we had 6 viewers, including a pleasant couple from Colorado. Docents: Gordon, Jim, Micky & Judy, and Brock

6 August: Thunderstorms were in the area, and most of the parking lot is now closed off for paving and curb work. I was there alone until 8:30, and gave it up as a cloud-bust.

13 August: The parking lot at UNMO has not yet been completed, and the typical August cloudiness is ever-present. I called it a night about 8:30.

I have learned that Jay’s wife, Ruth is seriously ill. My prayers go out to Ruth, Jay, and the entire family for a speedy and complete recovery.

To convert from Degrees, Minutes, Seconds: Divide seconds by 60, then add minutes, then divide by 60 again. For security reasons, GNTO location is available by request only, so please contact Pete Eschman for GNTO information.

Courtesy Pete Eschman

Monthly Membership Report
( July 2004)

Membership Current Month Past Month Change

Regular 245 241 4
Family 75 74 1
Educational 16 17 -2
Total Paid 332 349 -1
Honorary 4 4 0
Complimentary 10 10 0
Total Members 350 346 4

The Official Newsletter of The Albuquerque Astronomical Society
Oak Flat

Larry Cash

The August Oak Flat Star Party was another HUGH success. We had approximately 20 scopes and 125 visitors. All were treated to a great night sky from 9:00-11:00 P.M. We saw many of the familiar summer objects such as Globs - M3, M4, M13, M28, M54, and M69; Nebulae M16, M17, M20, M27, and M57. We saw galaxies as well, M81, M82 and M51 and if you stayed long enough and M31 and its companion galaxies. It started to cloud over around 11:00 P.M. and the crowd headed home. A few new comers to the group stayed around and after 12:30 A.M. were treated to beautiful open skies and two big 20 inch dob telescopes. Both Gordon Pegue and Peter Eschman treated everyone there to binoviewer views of M13, M57, double stars and the Moon. It you ever get a chance to look through the TeleVue or Denkmeier Binoviewer, please do so. “Its worth the time”. Thanks to the following for bringing and sharing their scopes with the public: Larry Cash, Bob Hugnegal, Brock Parker, Bruce Levin, Dale Murry, John Laning, Pete Eschman, Gordon Pegue, Richard Sedlack, Mark Shuchat-Marx (moral support for Bruce L.), Mark Dreger, Ed and Roey Juddo, Eric Edwards, Al Brettner, Jim Lawrence, Barry Gordon, Mike Flores, John and Arlene Ward, Jim, Bunny and Alice Kaminski, Mickey and Judy Bock and Richard and Susan Fate. “Way to go guys”. Thanks also to the two volunteers from the Forest Service: Jackie and Judy. They always treat us the best with enchiladas and other treats. Finally, thanks to Nancy Davis for keeping track of everyone bringing scopes. See you again in September for another Oak Flat episode.
The evening of June 30, 2004, was nail-biting time at Cassini Mission Control. After a seven-year journey that included gravity assist flybys of Venus, Earth, and Jupiter, Cassini had finally arrived at Saturn. A 96-minute burn of its main engine would slow it down enough to be captured into orbit by Saturn’s powerful gravitational field. Too short a burn and Cassini would keep going toward the outer reaches of the solar system. Too long a burn and the orbit would be too close and fuel reserves exhausted.

According to Dave Doody, a Cassini Mission Controller at the Jet Propulsion Laboratory (JPL) in Pasadena, California, there was a good chance the Earth-bound Cassini crew would have to wait hours to learn whether or not the burn was successful. Of the three spacecraft-tracking Deep Space Network (DSN) complexes around the globe, the complex in Canberra, Australia, was in line to receive Cassini’s signal shortly after the beginning of the burn. However, winds of up to 90 kilometers per hour had been forecast. In such winds, the DSN’s huge dish antennas must be locked into position pointed straight up and cannot be used to track a tiny spacecraft a billion miles away as Earth turns on its axis. “The winds never came,” notes Doody.

The DSN complex at Goldstone, California, was tracking the carrier signal from Cassini’s low-gain antenna (LGA) when the telltale Doppler shift in the LGA signal was seen, indicating the sudden deceleration of the spacecraft from the successful ignition of the main engine. Soon thereafter, however, Goldstone rotated out of range and Canberra took the watch.

After completion of the burn, Cassini was programmed to make a 20-second “call home” using its high-gain antenna (HGA). Although this HGA signal would contain detailed data on the health of the spacecraft, mission controllers would consider it a bonus if any of that data were actually captured. Mostly, they just wanted to see the increase in signal strength to show the HGA was pointed toward Earth and be able to determine the spacecraft’s speed from the Doppler data. If possible, they also wanted to try to lock onto the signal with DSN’s closed-loop receiver, a necessary step for extracting engineering data.

Normally it takes around one minute to establish a lock on the HGA signal once a DSN station rotates into range. Having only 20 seconds’ worth of signal to work with, the DSN not only established a lock within just a few seconds, but extracted a considerable amount of telemetry during the remaining seconds.

“The DSN people bent over backwards to get a lock on that telemetry signal. And they weren’t just depending on the technology. They really knew how to get flawless performance out of it. They were awesome,” remarks Doody.

Right after entering Saturn orbit, Cassini sent this image of the part of the Encke Gap in Saturn’s rings. Image credit NASA/JPL/Space Science Institute.


The Hubble Space Telescope isn’t the only satellite that scientists have fought to keep alive beyond its scheduled retirement. Scientists also went to bat for a satellite called EO-1, short for Earth Observing 1, back in 2001 when the end of its one-year mission was looming.

The motivation in both cases was similar: like Hubble, EO-1 represents a “quantum leap” over its predecessors. Losing EO-1 would have been a great loss for the scientific community. EO-1, which gazes back at Earth’s surface instead of out at the stars, provides about 20 times more detail about the spectrum of light reflecting from the landscape below than other Earth-watching satellites, such as Landsat 7.

That spectral information is important, because as sunlight reflects off forests and crops and waterways, the caldron of chemicals within these objects leave their “fingerprints” in the light’s spectrum of colors. Analyzing that spectrum is a powerful way for scientists to study the environment and assess its health, whether it’s measuring nitrate fertilizers polluting a lake or a calcium deficiency stressing acres of wheat fields.

Landsat 7 measures only 8 points along the spectrum; in contrast, EO-1 measures 220 points (with wavelengths between 0.4 to 2.5 μm) thanks to the prototype Hyperion “hyperspectral” sensor onboard. That means that EO-1 can detect much more subtle fingerprints than Landsat and reveal a more complete picture of the chemicals that comprise the environment.

As a NASA New Millennium Program mission, the original purpose for EO-1 was just to “test drive” this next-generation Hyperion sensor and other cutting-edge satellite technologies, so that future satellites could use the technologies without the risk of flying them for the first time. It was never meant to be a science data-gathering mission. But it has become one. “We were the only hyperspectral sensor flying in space, so it was advantageous to keep us up there,” says Dr. Thomas Brakke, EO-1 Mission Deputy Scientist at NASA’s Goddard Space Flight Center.

Now, almost three years after it was scheduled to be de-orbited, EO-1 is still collecting valuable data about our planet’s natural ecosystems. Scientists have begun more than a dozen environmental studies to take advantage of EO-1’s extended mission. Topics range from mapping harmful invasive plant species to documenting the impacts of cattle grazing in Argentina to monitoring bush fires in Australia.

Not bad for a satellite in retirement.
In past installments, I have discussed optics, the workings of telescopes and similar topics on the behavior of light in considerable detail. While refraction and reflection are two of the keystones in explaining optics, I have carefully avoided the other “-fraction,” diffraction. Although diffraction is an important part of many optical systems, it has the unfortunate reputation of being much more complicated and less intuitive than refraction and reflection. To make things worse, it is usually explained by resorting to some not-very-enlightening heavy-duty mathematics. In reality, diffraction is something that we literally see and hear every day and, with a little persistence, it is not too hard to understand.

Perhaps some of the difficulty in understanding diffraction stems from the fact that we usually think of light as a collection of rays traveling in straight lines. I use this approach frequently. It is simple, illustrative, and generally correct. Unfortunately, in the case of diffraction it does not explain the effect. To explain diffraction, we must first realize that light travels as waves rather than as rays. Fortunately, we have considerable everyday experience with the behavior of waves. Waves on the ocean, in your coffee cup, and sound waves all have a great deal in common with light waves and all exhibit diffraction.

To begin, consider the difference between rays and waves. Figure has three illustrations. Each one is a different illustration of waves or rays originating from a point and passing by an obstacle. The top section shows the behavior of rays. They travel outward from the point source. Some of them strike the obstacle, some miss the obstacle, and they simply continue in a straight line. Notice that the region immediately to the right to the obstacle has no rays. That area is in the shadow. I can replace the rays with waves where each wave is shown as a circle expanding outward from the point source. This is exactly the same as ripples in a pan of water moving outward from the spot where a drop hits the surface. Each circle represents the top of one of the waves. If waves behaved like rays, we would see wave patterns as shown in the middle section. Again, the section to the right to the obstacle is calm (has no waves).

Real waves behave like the bottom drawing. The wave seems to wrap around the corner. If you don’t believe this, you can prove it to yourself using a cake pan with a little water in it and a block for an obstacle. I did this experiment before writing this article and I saw the waves “wrapping around” the corner. What actually happens is, as a wave passes the corner, it suddenly has calm water along side of it. The wave simply starts to move into the calm water creating a series of ripples, one for each wave that passes the corner. The ripples expand outward as if they were originating from the corner. This is an important fact of diffraction, any corner acts as a source of waves, just like a drop in the water. I have drawn the ripples in a lighter gray to indicate that the waves are fairly weak, but they are still there.

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Figure 1: Behavior of light waves versus rays
We hear this effect every day through ordinary sound waves. If sound waves only traveled in straight lines, like rays, we could only hear things that were within a straight line-of-sight of our ears. If that were the case, I would not be annoyed by my neighbor’s barking dogs as I write this. We all know that we can hear things that are not in sight such as the telephone ringing in the next room. We are able to hear these things in part due to diffraction, or the bending around corners, of sound waves.

By now, you might notice something weird here. I have said that light and sound are both waves and that diffraction makes sound bend around corners. We don’t notice light rays behaving like this. Light may reflect from surfaces but it certainly does not wrap around corners - or does it? So what gives? The answer lies in the wavelength. Diffraction effects are most noticeable when the obstacles are about the same size as the spacing between waves (wavelength). Diffraction always occurs, even with light, it is just much less noticeable for larger obstacles. Typical sound waves are about a foot long while light waves are around 1/50,000 inch long. Because of this, sound waves bend (diffract) when passing through a 3 foot doorway because it is only 3 wavelengths wide. Light, passing through the same door is going through an opening that is over a million wavelengths wide, so diffraction effects are very, very small.

If the idea of light wrapping around corners seems strange to you, you are in very good company. Sir Isaac Newton never believed the wave nature of light because he could not see light traveling around corners, even though diffraction had been observed experimentally. He attributed diffraction effects to light refracting through the all pervading ether of space.

With ripples in a cake pan or waves on pond, it is easy to see the waves and watch them go by. Understanding the diffraction of light requires a little more ingenuity because we cannot see the individual light waves and the obstacles that cause noticeable diffraction tend to be small. Begin by looking at some waves from the side (Figure 2) instead of from above. The top of the figure shows a single wave with the various terms labeled. The other sections of the figure show pairs of waves and how they add up. When two waves combine, the height of the combined wave is the sum of the contributing waves. If one wave is high when the other wave is low they will cancel each other out - called destructive interference. If both are high at the same point the result is an even higher wave - called constructive interference. I’ve made several drawings with the two contributing waves drawn one above the other on the left and the combination drawn to the right. Every combination gives a wave of the same wavelength as the originals, just different amplitude. You never get a double crest or a double trough, just a different height. For sound, higher amplitude corresponds to more volume. For light, it means more brightness.

In my drawings in Figure 1, I used concentric circles to represent waves. Each circle marked the crest of a wave and the white spaces between the circles are the troughs. I can show two sources of waves with two sets of concentric circles (Figure 3). The figure has three sections. On the left, the two sources are 5 wavelengths apart. In the center, the sources are ten wavelengths apart. The right portion is a magnified view to show what’s happening. When I draw these sets of circles, something interesting happens. A pattern of stripes radiating from the sources emerges. The stripes are caused by the interference of the two wave sources with each other. The right part of the figure shows the stripes close up. Wherever the crest (black circle) of one wave meets
the trough (white space) of another, you see a solid black area since the black crests fill in the white troughs and the waves cancel each other out. In between these dark bands, the wave crests from one source line up, with the crests from the other and the same for the troughs. When this happens, the waves add up, resulting in a wave twice as high as that from either source. So the black stripes indicate calm (for water waves), quiet (for sound waves), or dark (for light waves) while the light areas are noisy or bright.

If you were in a wave pool with two wave makers you would notice some areas of the are calm and others that have unusually high waves. The effect is caused by waves interfering with each other. You may have also noticed this type of effect on the bass notes coming out of a stereo. The two stereo speakers act as two sources. You might hear some areas of the room where the bass is louder than others. Both of these are examples of interference from two sources. In both cases, what you observe is the difference in wave amplitude as you move around. I did the same thing mathematically to Figure 3, figuring out the wave amplitude (brightness of the light) at every point in the diagram. The results are shown in Figure 4. In the top of the figure, the sources are five wavelengths apart. In the lower part of the figure I used a shorter wavelength so the sources are 10 wavelengths apart. Everything else is the same. Notice how much closer together the light bands are. As the wavelength gets very short, the bands get so close together so that eventually they are indistinguishable from each other. In short, there always are bands but for most everyday situations they are so close together that they are impossible to see.

In the figure, I have used two point sources of light to produce the pattern. I mentioned earlier how waves traveling by an obstacle act like a new point source. This means that can produce these two point sources by shining light through two narrow slits. The light passing through each slit acts as a wave source. In fact, I did this by shining a laser pointer through a piece of glass with very closely spaced lines on it and onto a sheet of paper. The spaces between the lines are the narrow slits that act as point sources. The result is shown in Figure 5. The spots of light are the points where the bands of light from Figure 4 strike the paper.

So far, I have explained that light travels as waves, waves routinely bend around corners, and that this effect can produce light and dark bands by interference between two sources. The obvious question at this point is: what does all this have to do with telescopes? Unfortunately, this will have to wait until next month. Next time, I will show how this diffraction effect has a profound impact on telescopes, astronomy, and optics in general.
THE ALBUQUERQUE
ASTRONOMICAL SOCIETY BOARD
OF DIRECTORS MEETING. July 29, 2004

Present: Dale Murray, President; Heather Mann, Vice President; Shannon Mann, Treasurer; Elizabeth Burki, Secretary; Peter Eschman, GNTO Director; Board Members: Larry Cash, Gordon Pegue, Bob Hufnagle. Observer: Barry Gordon

Extraordinary announcement: Thanks to Karen Keese for her inclusion of our TAAS screensaver in the September 2004 issue of “Sky and Telescope”. We have now had our screensaver included in both national journals.

1. REVIEW OF JULY MINUTES: No comments.

2. TREASURER’S REPORT: (written report submitted)
   a. We have 3 new members and 5 lapsed members. Shannon will contact lapsed members to find out why they have not renewed.
   b. Payments were made to Barry Spletzer to cover the costs of printing and mailing the monthly newsletters and the expenses he incurred in GNTO repairs and refurbishments.
   c. Our post-office pre-sorted mail annual fee is $130.00. The board decided that we would not renew the pre-sorted fee because Barry Spletzer has already made arrangements with our newsletter mailing company to use their pre-sorted number to mail the newsletters.

3. CORRESPONDENCE:
   a. Two thank-you letters were received from our Broline winners expressing appreciation for their prize money and honorary membership in TAAS.
   b. Dee Friesen and Mickey Block have volunteered to work on the reupholstery for the guest trailer.
   c. Work meeting on April 22nd. Dome work continues. Dale Murray has been removing weeds from the site. We now have a large pond in the SE corner of the property thanks to the many rainy days.
   d. Both mounting plates for the servo mechanism for the Isengard have been replaced and the upgraded components will soon be attached.
   e. Pete has completed an Intel grant application form and is sending it to Barry Spletzer for his review.
   f. There was talk about restarting the CCD imaging program with a special interest group for imaging.
   g. We need to encourage more members to join the GNTO committee to help support existing members and to better share the workload.

5. PROSPECT:
   a. MEMBERSHIP MEETING: The “BLUE MOON” meeting will feature a presentation entitled, “The Dark Side of the Universe: Continuous expansion vs eventual implosion.
   b. Heather Mann solicited input for finding interesting speakers for upcoming meetings and will follow-up on the suggestions that were made.
   c. GNTO: August 17th will be our general observing night. Bob Hufnagle and Larry Cash will work on smoothing out our water-damaged road. The new toilet has met with rave reviews by our outhouse connoisseurs.
   d. Dale Murray will “own” the August 7th Oak Flat event.

6. COMMITTEE REPORTS:
   1. MEMBERSHIP: No report. We need to request that the newsletter indicate that Ray Collins has volunteered to take over the position of membership chair from Judy Stanley.
   2. GNTO:
      a. Committee met on July 22nd with three new committee members. On July 3rd the work party finished work on the outhouse. Dome work continues. Road maintenance issues were addressed including gossip and hearsay stories about an optic fiber line and water lines crossing the access road.
      b. Dee Friesen and Mickey Block have volunteered to work on the reupholstery for the guest trailer.
      c. Work meeting on April 22nd. Dome repairs are turning out well. Roof work continues. Dale Murray has been removing weeds from the site. We now have a large pond in the SE corner of the property thanks to the many rainy days.
      d. Both mounting plates for the servo mechanism for the Isengard have been replaced and the upgraded components will soon be attached.
      e. Pete has completed an Intel grant application form and is sending it to Barry Spletzer for his review.
      f. There was talk about restarting the CCD imaging program with a special interest group for imaging.
      g. We need to encourage more members to join the GNTO committee to help support existing members and to better share the workload.

7. EDUCATION: No report. We are looking for members to form a committee to set up and monitor next year’s school outreach program.

8. GRANTS AND OTHER INCOME:
   1. Intel grant application completed and sent to Barry Spletzer for review.
   2. Barry Spletzer continues to look for additional income sources, including a PNM grant.

9. OLD BUSINESS:
   1. Astronomy Day: Written confirmation has been received for the September 25th date. The event will be held either at the Sears or Foley’s courtyard at Coronado Mall. Heather Mann will do a “walk through” to figure out the best location. She has sent out 27 letters to astronomy and solar clubs soliciting their participation.
   2. We need a poster for Astronomy Day. Suggestion was made to hold a poster competition among youth members.
   3. We need member volunteers to help make Astronomy Day a success.

10. NEW BUSINESS:
    1. We need to get meeting topics and event notices to Karen Keese at least 3 weeks in advance so that she can disseminate them to print and radio media.
    2. There have been message problems with the hot line. Larry Cash has deleted old messages and hang-ups. Suggestion made that Heather Mann re-record the TAAS message along with clear instructions as to how to leave a message.
    3. Motion was made to discuss Board member roles and responsibilities at a special meeting. Suggestion made that each board member compile a list of duties and responsibilities which can then be shared by incoming board members.
    4. Barry Gordon presented an editorial describing how a special annual event in Placitas was cancelled because too few residents were willing to volunteer to make it happen. He pointed out that now too few people at TAAS are doing too much work. He will write a letter to the Sideral Times requesting members to come forward and share in the fun/work of making TAAS a strong organization.
    5. Motion carried to approve monies for Dale Murray to coat the 12 ½ inch mirror for the refurbished loaner scope. The monies for this will come out of the General Fund account.

Meeting adjourned at 9:15 P.M.
In a sweeping move to provide top quality communiques to our members while conserving our precious resources, TAAS is pleased to re-announce the availability of this newsletter the *Sidereal Times* in full color. That’s right, catch the blush of the monthly speaker, the blue eyes and red hair of that cute 6-year-old at the School Star Party, the depth and vibrance of all the full-color illustrations.

The catch is that the full-color version is only available at our website: www.taas.org. If you prefer to download and read your newsletter on your computer rather than receive a paper copy by mail, please notify the TAAS treasurer, Shannon Mann at treasurer@taas.org to have your name removed from the *Sidereal Times* mailing list. This will provide you with the newsletter of your choice, save TAAS money, and earn you the undying (okay, maybe slowly dying) gratitude of our Sid Times printer – me.

**Free Telescope Offer**

What’s that? Did you say Free? That’s right FREE!

Any TAAS member can use this coupon to borrow a TAAS telescope. Contact Dale Murray at telescope_loans@taas.org or 296-2479 and receive a loaner telescope absolutely free. You can choose from scopes with apertures ranging from 6” to 13”.

Some restrictions apply. Offer valid for current TAAS members. Offer is first come first served. Late comers will be put on a waiting list. Neither TAAS nor the telescope curators will be held liable for any lost sleep or other problems arising from the use of TAAS scopes.

Borrowers are required to enjoy the telescopes.

**Board of Directors - board@taas.org**

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