From the Ivory Basement

4. Reflecting on Refraction

Barry Spletzer

I had expected to discuss some basics about eyepieces this month. When I started to write about that, it occurred to me that some background is needed before I can get into eyepieces. This month and next will present this background.

Over the past several months I have talked a lot about telescope optics and how images are formed. However, the only optical surfaces I’ve talked about are mirrors. I have done this primarily because reflective surfaces (mirrors) are simpler than refractive elements (lenses) and because an understanding of reflection makes refraction simpler. Since lenses are essential to eyepieces and common in all sorts of telescopes, it is time to delve into this important topic.

When a light ray passes from one transparent medium to another it changes direction. Fortunately, this change in direction follows a fairly simple relationship called the law of refraction. Unfortunately, it is nowhere near as simple as the equal angle constraint for reflection. Figure 1 illustrates the law of refraction.

In the figure, I’ve shown two rays of light passing from air into a glass block. I’ve also drawn some dashed lines that are perpendicular to the glass surface. For each ray I’ve measured and dimensioned a distance of one inch along the ray each way from the glass surface. Finally, I have assigned dimensions to the distance that each ray is from the perpendicular at the end of one inch of travel. Keeping all this in mind, I have shown the equation for the law of refraction in the upper right. This law says that, for a given material, the ratio of the distances (x/y) is always the same. This ratio (n) is defined as the index of refraction of the glass and is the most basic property of an optical material. Optical glasses are available with indices of refraction ranging from 1.44-1.96.

If the definitions and equations aren’t quite clear, the important thing is that the index of refraction is always greater than 1, so the light ray inside the glass always lies closer to the perpendicular than the light ray in the air. This is the property that lenses work on.

Figure 2 shows what happens when a light ray passes through a prism (that is, in and out of a chunk of glass where the surfaces are not parallel). The ray enters the prism from the left and is bent downward (toward the perpendicular). It passes through the glass and, on exiting, is bent away from the perpendicular. Because of the fact that the two faces of the prism are not parallel, the result is that the light ray is bent downward at both surfaces.

With this behavior in mind, look at what happens...
ANNUAL POTLUCK
We come to the close of another year for TAAS, and for all who reckon beginnings and endings of years in this dark, cold and forbidding season. The sun has gone to its “southern house”, and the unaided eye can no longer detect its motion along the horizons – it is about 30 degrees south of East or south of West for Albuquerque – at sunrise and sunset. Indications are that this was no small concern in Chacoan culture: fields would remain frozen unless the sun could be coaxed back northward, and there must always have been some real anxiety that the ceremonies might be found wanting, their timing “off” enough to displease the sun. These sorts of calendrical worries were a stress in many primitive societies, and the solution was to develop the best astronomy that the technology of the period made possible: the sky is an excellent timepiece, but only the astronomers had the knack for reading it.

We have our own stresses, of course, and we observe the motions of the stars for the enjoyment it gives us – published calendars have replaced the priesthood of sun-watchers in our lives. But ceremonies and special traditions abound. TAAS’ version is the annual Potluck Dinner, a chance to eat well, struggle with the most entertaining trivia contest ever devised for astronomers, and enjoy wonderful fellowship. This year we are incorporating the presentation of the annual TAAS Awards. In short, if you expect to be on the face of the planet at 6:00 P.M. on Saturday, 21 December, you should plan to be at Heights Cumberland Presbyterian Church, 8600 Academy Road NE (at Moon). Bring family members and some food to share with others.

CALENDARS – SOME REFLECTIONS
As a youngster, I found no point whatsoever to beginning and ending calendar years in the drear of the New England winter. I suppose that if pressed, my preference would have been that more exultant day when we ended our passage through another grade in school, were promoted to the next (most of us) and began that most fabulous of all childhood institutions, the summer vacation. (Is that the real reason I went into teaching?) Now, in my dotage, I guess I would favor the Spring Equinox, fully in keeping with a tradition going back 5,000 years in Mesopotamia, the Persian, Bahá’í and Zoroastrian festival of Naw-Ruz (“New Day”). The sun’s passage northward over the equator is, after all, a real celestial event, heralding the renewal of a growing season in the northern hemisphere and its fulfillment in the southern hemisphere. Days and nights are pretty much equal worldwide – this is the nondiscriminatory New Years Day.

Elul is familiar to Jews and all passionate crossword puzzlers: the thirteenth month of the Jewish calendar. We learn that this calendar is a masterpiece of celestial harmonics, bringing agreement between tropical years and synodic months – twelve months being about 11 days short of one year. Utilizing ordinary years of 353-355 days (in twelve months) and leap years of 383-385 days (in thirteen months), things work out very nicely, a lunisolar calendar. I see this as a calendar that dared to be thoroughly modern thousands of years ago: when the New Year begins with a new moon, so does each month! With a variety of “new year” beginnings, it is Rosh Hashanah that predominates, its serenity and serious purpose such a beautiful contradistinction to all that is garish and silly on December 31st.

OTHER CALENDAR MATTERS
One of the final rights of passage for the old Board is formulating the calendar for the coming year, and it is a formidable challenge. Dave Brown took charge in yeoman fashion, serving as the monkey-in-the-middle through all the early rounds, and presenting both calendar and the annual budget for the Board’s minor tweaking and speedy passage at the November meeting. Well done, Dave. Kudos as well for Pete Eschman: the GNTO budget and inventory is a very large part of the Board’s responsibility that cannot be done without true adult supervision. At GNTO, Larry Cash has always been at work, supporting every team effort.

The administrative year that is now ending has been a good one. In fiscal terms, the good fortune of our partnering with the National Park Service on the dark sky survey at Chaco (thanks to Chris Wilson) and the Night Sky Conference (untellable thanks to Karen Keese), and the unstinting services of Eric Bucheit and Barry Spletzer in locating and harvesting corporate grants, have meant that we have rarely said “Can we afford that?” Our coffers are fairly groaning! Our “firsts” include joint ventures with the Lodestar Astronomy Center, including an Astrophotography Contest/Exhibit that continues to reflect well on both our organizations. We have an enormous debt of gratitude to David Blair and Neil Goldberg. We continue to impact the public with School Star Parties (Way-to-go!, Judy Stanley and Sammy Lockwood) and a web site that makes us all look good (again, Way-to-go! Sammy). Finally, I am so proud that TAAS has a newsletter that visitors to my home and classroom have picked up and really admired. Dan Richey combines uncommon skills as Editor with the patience of Job in dealing with me, and has my most sincere admiration and heartfelt thanks.

Personally, the privilege of working (and playing!) with these amazing, brilliant and dedicated people has been fabulous: I’m sure that no president has ever enjoyed such a sinecure. Dave Brown and I forge ahead, joined by Elizabeth Burki (Secretary) and Dale Murray (Vice President) as another Board takes shape. Look for great things.

All best wishes, from me, for a wonderful new year with TAAS!
**Highlights of the November 23 General Meeting**

Our 2002 general meeting lecture series concluded with an outstanding presentation by Dr. Paul Krehbiel of the Langmuir Laboratory for Atmospheric Research, entitled “Studying Lightning Inside Thunderstorms.”

Langmuir, located near the 10,000-foot summit of South Baldy Peak in the Magdalena Mountains, was built in 1963 with funding from the National Science Foundation. The purpose of the facility is to study storms, and it is well situated in a hotbed of thunderstorm activity.

Dr. Krehbiel has been involved in research at Langmuir since the 1960’s. His research interests are lightning studies, thunderstorm electrification, and radar meteorology.

Dr. Krehbiel informed us that the most interesting aspects of lightning occur inside storms, where they are obscured by the storm cloud. Clouds, however, are fully transparent at radio frequencies, and lightning is a strong source of radio frequency radiation. During storms, these radio signals can be seen as interference on broadcast TV and heard as static on AM radios.

The system recently developed at Langmuir to create three-dimensional radio images of lightning as it develops inside storms is called the Lightning Mapping Array (LMA). This is a Socorro-County-wide network of 13 GPS-equipped (Global Positioning System) stations that collect radio data from storms and measure the time that each image arrives. A wireless Ethernet links the data collected at each station back to a central processing location. The distance of the lightning can be determined from the time it takes to travel from the “event” to each station. Typically, six or more stations are measured in order to correlate and verify the data. Dr. Krehbiel noted that GPS and wireless networks have revolutionized the data collection process for this sort of research.

In New Mexico, 14 kilometers (8.5 miles) above sea level is the highest point of the range within which lightning occurs. Lightning typically starts to occur at an altitude where the temperature is negative 10 to negative 20 degrees Centigrade (14 to negative 4 degrees Fahrenheit). In addition, the electrical charges inside a thunder cloud are temperature banded, hence the “layering” effect of either negative or positive charges. There can be both negative and positive cloud-to-ground lightning discharges. But there are also successive charges moving horizontally through the storm. These inter-cloud charges are being understood only within the last 10 to 15 years, because of the advancements in radio imaging that allow scientists to peer beneath the cloud cover.

One discharge of lightning can send ten strokes down to the ground in half a second. We see this as flickering, but an image taken with a slowly moving camera will reveal the separate strokes.

Dr. Krehbiel told us about a phenomenon known as a “bolt from the blue”. This is a lightning discharge from the side of a storm. Because of its unexpected appearance, at a considerable distance from the storm core, it is considered relatively dangerous. This phenomenon is quite common in New Mexico; every storm makes a couple of these discharges, sometimes several miles from the storm center.

An LMA-like network called STEPS has been used for several field studies of the large, severe storms of the western Great Plains. Detecting lightning over distances has been quite successful, although it is always limited by the local horizon and the sight line. Dr. Krehbiel showed us an amazing radio image, captured near the Kansas/Colorado border, of a 25-mile-long discharge! The duration? Just two seconds.

We were also treated to a fascinating radio image of an airplane’s collision with ice crystals in a thunderstorm cloud. This sort of encounter charges the metal skin of an airplane, which shows up on radio images as “sparks” coming off of the plane.

Dr. Krehbiel spoke of “supercell” storms, the severe storms typically seen in the Great Plains states. These are the tornado producers, and they exhibit different dynamics and charge patterns from the garden-variety thunderstorms seen in New Mexico. He also spoke of a “freight train updraft”, a 100-miles-per-hour convective surge that erupts upward from a storm. Dr. Krehbiel wrapped up his excellent lecture by showing us several striking animations (created using LMA data) of lightning activity and of a supercell storm that produced a tornado.

I spoke with Dr. Krehbiel about a possible TAAS field trip to Langmuir in the summer of 2003, and he was very encouraging. Interesting research and a beautiful locale—what more could one ask for in a field trip? Watch for details in a future Sid Times!
January 2003

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NAMN Notes is a monthly newsletter produced by the North American Meteor Network, and is available both via email, and on the NAMN website at: http://www.namnmeteors.org

Geminids - The Final Highlight of the Year...
The Geminid meteor shower is the final highlight of our meteor year! The rates are good, the meteors are bright, and the nights are long. It’s a great shower for all observers, and especially for new observers who have joined us since Leonid time. The International Meteor Organization (IMO) refers to the Geminids as ‘one of the finest annual showers presently observable’.

The Geminids (GEM) reach a maximum on December 14th, probably about 10h UT, according to comments in the 2002 IMO Meteor Shower Calendar. For eastern North American observers, this means 5 a.m. EST. Hence the best ‘night’ to watch is the evening of the 13th and the morning of the 14th. The shower lasts from about December 7th to 17th. According to the IMO, ‘well north of the equator, the Geminid radiant rises around sunset, and is at a usable elevation from the local evening hours onwards. For those interested in trying observations of this shower telescopically, the fainter meteors should peak about a day before the regular peak. For those who (heaven forbid) might be clouded out on the 13/14th, good meteor rates can also be seen before and after that night. December’s Geminids are the last major shower of the year - so bundle up and get out to observe!

STARDATE
J.D. Palmer
Albuquerque, NM-KUNM 89.9 FM airs STARDATE nightly @ 7 P.M. (weekends @ 6 P.M.). It is a 2 or 3 minute short radio piece about astronomy. Subjects include: that night’s sky; cosmology; astro-history; new astro discoveries. Produced by the folks @ McDonald Observatory. See: http://www.stardate.org

Need Rain? Too Much Blue Sky?
***Schedule a Star Party with TAAS***
• Safe and Effective
• Environmental
• Guaranteed Results
• Contact Sammy

The Official Newsletter of The Albuquerque Astronomical Society
## February 2003

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### Notes

GNTO = General Nathan Twining. Observatory - premium observing night.
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.
PandA = UNM Physics and Astronomy. Corner of Lomas and Yale.

The Amateur Telescope Making Workshop

ATM 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.

December 21
Saturday, 2002 6 P.M.
Solstice Pot Luck & TAAS Annual Awards Presentation

Heights Cumberland Presbyterian Church
Moon @ Academy NE

The Official Newsletter of The Albuquerque Astronomical Society
Minutes of the Board of Directors Meeting

David Blair (This month’s minutes courtesy Karen Keese)

Minutes of the TAAS Board of Directors meeting of November 21, 2002

Physics and Astronomy Building, UNM

President Ray Collins called the meeting to order. Attending were the president, Karen Keese (vice president), Dave Brown (treasurer), Neil Goldberg, Dan Richey, Pete Eschman, Eric Bucheit, Judy Stanley, Chris Wilson, Larry Cash, and Barry Spletzer. Secretary David Blair was absent. Observers in attendance were Mark Kroska, Barry Gordon, and Sammy Lockwood.

Treasurer’s Report

Dave Brown submitted the November report. Checking account funds are $13,751.17, up $2,278.28 from the previous month. Savings account balance is $0.00, down $1,188.09 from the previous month. These changes reflect the combination of the savings and checking accounts, in order to realize savings on service charges. Total funds on deposit are $13,751.17, up $1,090.19. Special funds totals are: General $5,074.04, Observatory $6,175.29, Education $1,615.49, Explorer $66.99, Dark Sky $279.36, Broline $500.00. Major revenue: Chaco Survey payment #4 of $2,000.00, memberships $580, donations $60, GNTO CD sales $80. Major expenses: Sefick equipment payment $1,000.00, newsletter $349.08.

Chris Wilson reported that the second and final payment of $1,500 for the Night Sky Conference had been requested from the Park Service.

Correspondence

Ray read a letter from Brad Shattuck of Chaco informing us that Chaco had applied to the New Mexico Heritage Preservation Alliance for endangered status. Ray has also received the annual request for judges for the Regional Science Fair, and will discuss this with Bruce Levin.

Retrospect

Elena Gallegos star party was clouded out; Los Griegos School star party was well attended by about 200 students; the 2002 Leonids provided a good shower, but not a storm as in 2001- the board heard reports from Oak Flat, GNTO, and Placitas.

Prospect

Dr. Paul Krehbiel of Langmuir was scheduled for the November 23 general meeting with a lecture on lightning; GNTO training was scheduled for November 30; Ray Collins volunteered to be the event owner for the December 21 annual potluck at Heights Cumberland Presbyterian Church.

Committee Report-Membership

Neil is handling the messages from the TAAS hotline; some are membership inquiries. He has sent 16 letters so far to lapsed members with only one response; he will continue this tactic for a little longer and then evaluate its effectiveness.

Committee Report-GNTO

Pete reported that the Committee has decided to try to pay the Sefick balance by June 30 (75% paid to date) and that John Sefick had donated a number of copies of his recently produced CDs to TAAS as a way to raise money to pay off the balance. The Committee is considering how to best use the remaining Intel imaging-support grant funds. Dave Wilson and Joel C. de Baca have offered their electrical expertise to support the supply of 12-volt power to the Astrophysics dome. A work party is scheduled for November 30. Dome redecking/solar panel relocation for the main dome is tentatively scheduled for February/March 2003. The screensaver project team is scheduled to meet the first week in December.

Committee Report-Nominating

Karen reported that the Committee of Judy Stanley, Barry Spletzer, and Karen Keese had identified the slate of officers for 2003. They are Ray Collins, President; Dale Murray, Vice President; Liz Burki, Secretary; Dave Brown, Treasurer. The slate will be offered to the membership for ratification at the January 18 general meeting. Ideas from the Committee included designating a Treasurer trainee, appointing a student board member, and encouraging board members to take TAAS jobs with them when they leave the board.

Committee Report-Education

Sammy indicated that the school star party season has a great start and that the schedule is almost full.

Committee Report-Grants

Eric and Barry requested that board members submit funding requests to them. Sammy noted that he needs LCD projectors for the Education program. Barry is going to solicit equipment donations for the Loaner Telescope program.

Ray noted that the Awards Committee was Neil Goldberg, Linda Hixon and Steve Snider, and that nominations for the Isengard award, the Dobson award, and the Service awards should be emailed to them, as should completion of the Messier, TAAS 200, or Herschel observing lists.

Calendar

The board then spent some time fine-tuning the events calendar for 2003, which had been drafted by Dave Brown. The Society is returning to a general meeting schedule that most closely coincides with the full moon. Dates for special events such as Chaco and Oak Flat were firm up. Barry Gordon proposed a later date for the Placitas Star Party, in the hopes of realizing better weather for that event; the board agreed to this and selected November 1. Karen presented a suggestion from Gordon Pegue for a special event coinciding with the great Mars opposition in August 2003. The board decided to have an event at the UNM Campus Observatory on Friday, August 22, and to also promote Mars for the Oak Flat event on the following night of August 23. There was some discussion of changing the newsletter deadlines to better accommodate Dan; he will think about it.

Inventory

Dave Brown presented a model of a more detailed asset inventory and asked board members to provide any available detailed information, such as date donated and donor, for each piece of equipment, so that TAAS records can be as complete as possible. The board acknowledged Dave’s fine work on pulling together both the 2003 calendar and the inventory form.

Budget

Dave then presented the 2003 General Fund budget. Pete presented the GNTO budget and the board approved a transfer of $800 from the General Fund to the GNTO Fund, to cover the cost of much-needed roof repair on the main dome. TAAS is in receipt of a donated photocopier from Cooney, Watson and Associates, an Albuquerque public relations firm. The photocopier will be stationed at Sammy Lockwood’s house.

La Semilla

Ray and others met with David Simon of the State Land Office. The Savory Corporation will be leasing a large plot of land at La Semilla, which would encompass the land that TAAS had been considering for astronomical use. It is proposed that we sublet the land from Savory. Further discussion is required.

Karen presented a member’s suggestion that complimentary TAAS membership be extended to long-standing members. This suggestion is under consideration by the board.

Neil asked for board support for the 2003 TAAS/LodeStar astro-photography contest. The board indicated that Neil should proceed with this event. The Grants Committee will look into getting sponsors for monetary contest prizes. Judy informed the board that National Science Teachers Association members would be at LodeStar on Friday, December 6, and that this would be a good TAAS outreach opportunity. Judy also distributed a request from the Astronomical Society of the Pacific for volunteers to join an advisory board developing a NASA outreach kit.

Ray adjourned the meeting.

The Official Newsletter of The Albuquerque Astronomical Society

January 2003
Enlightened by the Darkness

Diane K. Fisher

On the clearest of nights, I may see a dozen stars from my suburban backyard near Los Angeles. Unfortunately, my studies of space and astronomy have been confined to books and the pictures taken by others. Seldom have I experienced for myself a truly dark, clear, moonless sky.

One of those rare times was a summer camping trip in Bryce Canyon, Utah. I lay on my sleeping bag in an open area away from trees. I saw millions of stars (so it seemed) and the cloud of the Milky Way streaking across the sky. Nothing of planet Earth was in my view. It was then I glimpsed my true situation in the universe, a speck of dust clinging to a tiny stone hurtling through the darkness of a cold, infinite universe. I was awestruck by the beauty of the stars and the darkness-and terrified!

In the light of day and a more “down-to-Earth” state of mind, I wondered: With around 100 billion galaxies out there, why is it still so dark out there?

Until the 20th century, astronomers thought the universe was infinite. They were perplexed though, because in an infinite universe, no matter where you look in the night sky, you should see a star. Stars should overlap each other and the sky should be blazing with light and hot as the sun. This problem became known as “Olber’s Paradox.”

Astronomers now realize that the universe is not infinite. A finite universe—that is, a universe of limited size—even one with trillions of stars, just wouldn’t have enough stars to light up all of space.

Although a finite universe is enough to explain the darkness, the expansion of the universe also contributes. As light travels from a distant galaxy to us, the space through which the light is traveling is expanding. Therefore, the amount of energy reaching us dwindles all the time, thus causing the color of the radiation to be “redshifted.” (The wavelength is stretched out due to cosmic expansion.) The more distant the galaxy, the more redshifted the light. The largest redshift astronomers have measured comes from radiation that was emitted when the Universe was only 300,000 years old. This radiation has taken over 12 billion years to reach us and although it began as infrared radiation, it is now seen as the microwave background radiation.

GALEX (Galaxy Evolution Explorer) is a NASA space telescope that will survey the universe, including galaxies with redshifts that indicate their light has been traveling for up to 10 billion years (or 80% of the history of the universe). Read about GALEX at www.galex.caltech.edu/. For budding astronomers, print out The Space Place New Millennium Program calendar at spaceplace.nasa.gov/calendar.htm to identify great sky watching opportunities.

This article was provided by the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.
There have been two GNTO Committee meetings since the last newsletter article, one on November 14th and one on December 12th. Committee members attending both sessions included Larry Cash, Ray Collins, Karen Keese, Mark Kroska and Gordon Puege, while Elaine Kroska and Dale Murray also attended the November meeting. In November we worked on the GNTO budget for next year and finalized our assets inventory for this year. We decided to ask the Board of Directors for $800 from the Society’s general fund to help pay for maintenance on the main dome roof deck, which will take place in the February/March time frame next year. This request was approved at the Board meeting the subsequent week.

TAAS members Joel C. de Baca and David Wilson have offered to help us upgrade the electrical wiring from the main dome building to the 10-foot dome. We really appreciate the generosity of these two licensed electricians, and the improvements will allow us to provide better power and lighting for future use of the smaller dome.

At our December committee meeting we discussed a variety of improvements to our imaging system and to the motor drive of the Isengard telescope. The screensaver fund raising project group met earlier in the month. This group consists of Larry, Mark, Gordon and Karen. They reported good progress on a number of technical issues and indicated that the project may be completed within the next few months. I reported that we had made another payment to John Sefick for the equipment we had purchased from him. At this point we have paid John 3/4 of what is due. We have set a target of the end of June 2003 to pay off the remaining amount.

John has donated a number of multimedia CDs, which are in the Video CD format. These are being offered for free with a $20 donation to help us pay for the equipment purchase. John describes these CDs as “An astronomical audio-visual presentation for planetarium and classroom use”. They feature a series of astronomical object CCD images, which are animated using pan and zoom effects and accompanied by a narrative and music sound track.

There are two versions, “Cosmic Images” and “Modern Astronomy at Chaco Canyon”. Both CDs have similar image content. “Cosmic Images” has a somewhat longer run-time (42 min), while “Modern Astronomy at Chaco Canyon”, (30 & 1/2 min) uses many of the same images and narrative, along with a few Chaco Canyon images and a 3 & 3/4 minute introductory section on Chaco Canyon. I will have copies available at our December Solstice Potluck, and at the next TAAS general meeting in January.

November 30th marked our last GNTO training session of the year. Poor weather and a Thanksgiving holiday weekend resulted in reduced attendance. We also had a small work session at GNTO that started around noon the same day. During the work session, we used the generator to equalize our battery bank, and we lubricated the clutch on the Isengard mount. Folks helping with the work party included Carl Frisch, Karen Keese, Larry Cash, Dale Murray and myself. Dale was able to refurbish the clutch assembly cover, which will help to keep dust away from the mechanism. Carl and Mark made significant progress in formalizing setup procedures for the new G-11 goto mount.

Around seven more people arrived later that evening for training and observing. In the evening we rebalanced the Isengard telescope. This work was needed now that the Right Ascension axis clutch was moving more freely and the scope is now much easier to center on a desired object. We also found that the G-11 mount worked very well when controlled from the software interface of the computer in the Ortega building. Mark was able to get some good imaging done and trained a few more folks in the procedures for CCD imaging. Clouds rolled in around 11:00 that evening, so we packed up a bit early.

Poor weather caused the cancellation of our December 6th observing event. I put a message out on TAAS-L indicating that the weather forecast was too bad, and that no one would be at GNTO to open things up. We are all hoping that the weather gives us a break for our future events.

Our listserv is perfect for spur-of-the-moment announcements, updates on school star parties, notices about our Backyard Astronomy program, Sidewalk astronomy encounters, and general astronomy talk. If you are not a TAAS-L subscriber, you need to join! Instructions can be found on our web site, or contact me for details. The web site instructions are on our first page, just scroll down and look for the section “Get Online with TAAS E-mail List Server”.

Our next GNTO events are observing sessions on December 28th and January 6th. If folks plan to be at GNTO on Friday the 5th, we will post a notice to TAAS-L listserv. January 6th promises to be a good event since it is only two days after the new moon, and we have some great equipment waiting for you to put to use.

Our next training session is on January 25th. We will provide instruction on GNTO equipment use, ranging from the Level 1 - Isengard Telescope, to Level II - computer interface, through the Level III - CCD training. We plan to do the Level III instruction using the Losmandy mount and Celestron optical tube assembly. The Level II software interface training will apply both to the Isengard and the Losmandy/C-11 configuration, since both use TheSky software. With the software interface established, you can see where the telescope is pointing on the sky chart on the computer screen, and you can also use the computer to guide or slew to any of the objects in the software database. We will pass out laminated GNTO Glove Box Guides to all who attend our training. These handy guides are well worth the trip alone!

GNTO committee meetings are open to all interested TAAS members and our next scheduled meeting is January 9th. As usual, this date is a Thursday, one week before the TAAS general meeting. Our new meeting location will be JB’s restaurant on the southeast corner of San Mateo and Montgomery and the meeting starts at 6:30 P.M. If you have questions about access and availability of GNTO, please contact me (Pete Eschman, gnto@taas.org, home phone: 873-1517, work phone: 277-0020.) I hope to see you soon at our observatory.
The Sidereal Times
January 2003
Page 9

The Official Newsletter of The Albuquerque Astronomical Society

Donations to TAAS

TAAS General Fund: Las Placitas Association

Membership Services

• Membership Inquiries
• Events Information
• Volunteer Opportunities

Contact Neil Goldberg at membership@taas.org
505/798-1958

for:

• Membership Dues
• Magazine Subscriptions
• Address/E-mail Changes

Contact Dave Brown at treasurer@taas.org
505/275-9126
PO Box 50581 Albuquerque, NM 87181-0581

UNM Report

Jay Harden, UNM Campus Observatory Coordinator
unm_coord@taas.org

8 Nov: 100% cloudy. There were two TVI potential viewers. I left about 7:30.

15 Nov: Cloudy.

22 Nov: Best night in ages and I missed most of it. Had to take my computer to the computer maechanic. It now has a new hard drive. There were 65 viewers. Docents: Becky, Mark, Brock & Ray. Mark was there until 11:30.

29 Nov: Cloudy, windy and cold. No visitors. Mark & I left around 7:30.

6 Dec: I arrived at UNM about 5:45. There were a few clouds. There were more clouds and no visitors. I left at 7:50.

TAAS Reports/Notices

Dial 254-TAAS for Updates

The TAAS hotline is now bigger and better! The hotline now offers updates on TAAS monthly meetings (press 1), TAAS special events (press 2), and TAAS school star parties (press 3). If you have a special TAAS event that you would like to announce on the hotline, e-mail your announcement to sammy@taas.org

Location, Location, Location

• Chaco Canyon
6185’ elevation
Latitude  Longitude
36˚ 01’ 50"N  107˚ 54’ 36"W
36.03˚  -107.91˚
36˚ 1.83’  -107˚ 54.60’

• Oak Flat
7680’ elevation
Latitude  Longitude
34˚ 59’ 48"N  106˚ 19’ 17"W
34.99˚  -106.32˚
34˚ 59.80’  -106˚ 19.28’

• UNM Campus Observatory
5180’ elevation
Latitude  Longitude
35˚ 5’ 29"N  106˚ 37’ 17"W
35.09˚  -106.62˚
35˚ 5.48’  -106˚ 37.29’

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.

New IDA Student Award

During the IDA’s annual spring meeting, we will be presenting awards for educational work that has been done concerning light pollution, by school students worldwide.

The awards are given in honor of George and Edythe Taylor. George was a well known, long-time lighting engineer who won honors from the Illuminating Engineering Society of North America (IESNA) for his contributions to the field. He was always interested in and supported education.

Submissions will be judged in three grade ranges: Kindergarten to 6th, 7th to 9th, and 10th to 12th. Winners receive a monetary award. Submissions are due by February 7, 2003. For more information, visit http://www.darksky.org/education/edaward.html.

This message was contributed by the International Dark-Sky Association in Tucson, Arizona.

Monthly Membership Report

(November, 2002)

Dave Brown, treasurer@taas.org

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</tr>
<tr>
<td>Total Members</td>
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<td>314</td>
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</table>

Definition of the Month

Resolution - A measure of the minimum angular separation between two sources at which they can unambiguously be distinguished as separate.
when a group of parallel light rays passes through a lens. Figure 3 illustrates this. The ray passing through the middle of lens simply goes straight through since it is perpendicular to both surfaces. Anywhere else on the lens, the ray acts just like it is passing through a prism. The farther from the center of the lens the greater the angle between the front and back surface of the lens and the greater the amount of total bending of the light ray. If the surface of the lens is properly shaped, all of the rays are bent the proper amount so they all converge at a single point. It turns out that, to a first approximation, a spherical lens surface focuses the rays to a single point. Just like in the case of forming an image with a curved mirror, the property of causing parallel rays to converge to single point is the primary requirement to form an image.

One important difference between mirrors and lenses is that it is much easier to put a bunch of lens surfaces together than a bunch of mirror surfaces. Even the most complex reflecting telescopes use no more than three curved mirror surfaces. One curved mirror for a Newtonian or two curved mirrors for a Schmidt-Cassegrain is usually about the limit. In contrast, even a simple achromatic lens for a refractor has three optical surfaces with two different types of glass and a Plossl eyepiece has six optical surfaces and four pieces of glass. Each surface can have a different shape and each lens could use a different type of glass. This allows for a great number of design parameters to optimize the system.

Along with the ease of using multiple lenses comes the significant drawback of dispersion. All optical materials exhibit dispersion. This is the behavior where the index of refraction is different for different colors of light. Specifically, red light (long wavelength) is always bent less than violet light (short wavelength). This property allows prisms and raindrops to form rainbows but can produce undesirable rainbows in our telescope images. Figure 4 shows how dispersion affects white light passing through a lens. In short, the focal point for the red light lies farther from the lens than that of the violet light. This means that a sharp image does not exist and instead the image is a fuzzy rainbow.

This rainbow effect is called chromatic aberration and is one of the main reasons why Newton invented his reflecting telescope. Chromatic aberration is commonly suppressed by using two different lenses with different dispersion and refractive index. This is called an achromatic lens. Figure 5 shows this arrangement. By properly choosing the two lens materials and shapes, both the red and violet rays can be brought to focus at the same point. With two lenses, only two colors of light can be brought to focus at the same point. Other colors will still focus at different points. In short, the achromatic lens significantly suppresses chromatic aberration but does not completely eliminate it. Other arrangements with three materials are sometimes used to suppress chromatic aberration further.

This installment has been a crash course in how refraction in general and lenses in particular work. These basic principles are essential to understanding lenses and optical systems. So far, everything has been nice and perfect in that a bundle of parallel rays always focuses to a nice sharp point. In reality, this is not the case. Numerous effects, like chromatic aberration discussed above, cause the images to be imperfect. Next time, I will give a quick overview of what these imperfections are and where they arise.

This is the fourth in a series of articles on optics by Barry Spetzler. I wish I had paid more attention in physics class. Excellent work Barry, thank you. Ed.
Special Interest Groups (SIGs)

As we near the close of another year, everyone at IDA would like to wish you the very best for the holiday season. This past year has been very successful, and momentum continues to build around the world. All of this progress has been made possible by your outstanding efforts. Our membership continues to grow, and IDA is very near 10,000 members from 75 countries.

Lighting Awards: The deadline is only a few weeks away in mid-January, and now is the time to be thinking about IDA’s awards. We would especially like each of you to nominate the best quality lighting in your areas. Whether it’s the excellent lighting at the Malta International Airport, the energy efficient street lighting in Brno, Czech Republic, or the low glare Port Authority Lighting in Cagliari, Sardinia, Italy, a National Park redesigning lighting to protect wildlife, or a quality installation in “anycity USA,” we are sure everyone will want to send us nominations.

How to Submit Awards: We will have instructions available soon on our web site (www.darksky.org). In brief summary, we need (via email) a justification of the lighting award, a digital photo, and complete contact information for both the property owner and the lighting designer or installer. The nominations don’t need to be for installations completed in the last year; they can be for older installations.

This is a great way to give recognition to those who are promoting better quality lighting. Press releases are planned, and there will be various awards presented at the IDA annual banquet in March.

Desert Sunset Star Party
May 1-4, 2003

The Desert Sunset Star Party (DSSP) is one of the newest amateur astronomer star parties in the US, scheduled for May 1-4, 2003 at the Kartchner Caverns State Park in Benson, AZ. Additional information and registration forms are now on our website: http://chartmarker.tripod.com/sunset.htm.

We invite you all to come and enjoy the dark southern Arizona skies and the many attractions in this area.

In the late afternoons as we wait for dinner, we will have a few of the seasoned amateurs and professionals demonstrating specialized techniques. We will have a swap meet on Saturday afternoon followed by a contest for your homemade innovative astronomy gadget.

After dinner, attendees can listen to speakers at the amphitheater while we wait for the Sun to set. We still have openings for speakers - please contact us if you are interested. We should have a good selection of door prizes donated from some local businesses and other vendors we have contacted in our star party travels.

During the days, we are encouraging attendees to visit places like Kitt Peak, the UA Mirror Lab and Flandrau Planetarium, the Pima Air and Space Museum and Titan Missile Silo, and of course the many non-astronomy related sites such as the Arizona Sonora Desert Museum, Old Tombstone and much more. Check our Day Trip links for details. (If you plan to tour Kartchner Caverns (advanced registration is required for this very popular tour) you can access the Cavern tours through our Day Trip links.)

Chart Markers and More
Pat and Arleen Heimann
http://chartmarker.tripod.com

Call For Lighting Award Nominations

The following is a message from Bob Gent, board member for the International Dark-Sky Association (IDA). This would be a great opportunity to generate some positive publicity in New Mexico for those organizations and individuals who have done a good job in employing night-sky-friendly lighting. So start looking around and send in your nominations!

Memorandum for all IDA sections, Affiliates and Friends:

If cloudy/rainy, the event will be cancelled. A message about cancellations will be on the hotline (254-TAAS) by 6 P.M. Check the website (taas.org) for updated information.

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Chart Markers and More
Pat and Arleen Heimann
http://chartmarker.tripod.com
TAAS Awards Nominations

Neil Goldberg

Well, it’s that time of the year again. The Awards Committee is soliciting nominations for persons who have contributed significantly towards helping TAAS achieve its public outreach and education goals in the last year. To help you in your selection, the Committee has compiled a description of the various awards. Please contact Steve Snider, Chairman (or Neil Goldberg/Linda Hixon) with your nominations as soon as possible.

- **MESSIER AWARD**: For observing all objects on the Messier 110 list.
- **TAAS 200 AWARD**: For observing all objects on the TAAS 200 list.
- **HERSCHEL 400 AWARDS**: For observing all objects on the Herschel 400 list.
- **THE COLONEL LEONARD C. BROLINE MEMORIAL AWARD**: Given in connection with the New Mexico Regional State Science and Engineering Fair or for students who would not otherwise be able to afford science or astronomy classes or camps. These are awarded at the time of the science fair.
- **THE JOHN DOBSON AWARD**: An annual award given to an individual in the community that has a “clear and outstanding record of sustained activity in public education.”
- **SERVICE AWARDS**: Annual awards given to individuals “for sustained and selfless participation toward the advancement of The Albuquerque Astronomical Society.”
- **THE COLONEL WILLIAM S. ISENGARD AWARD**: An annual award “given to the individual in the community that has shown exceptional generosity to the society.”

Election of 2003 TAAS Officers

**PLEASE READ THIS VERY IMPORTANT MESSAGE FROM THE BOARD OF DIRECTORS:**

Please mark your calendar now for our first general meeting of 2003, on Saturday, January 18. This is our annual membership meeting and is the meeting where you will elect officers for the 2003 Board of Directors. It is VERY IMPORTANT that every member possible attend this meeting, because we must have a quorum of 20% of the full membership (those with voting privileges) in order to validate an election. The meeting will be held at Regener Hall on the University of New Mexico campus in Albuquerque, New Mexico, and will commence at 7:00 PM.

If for any reason you will not be able to attend this very important meeting, please either: 1) request a Proxy Ballot from our Treasurer at TAAS, PO Box 50581, Albuquerque, New Mexico, 87181-0581 or treasurer@taas.org, or 2) copy the form below. Mail the completed form to the TAAS Treasurer at the address above.

The Nominating Committee of Barry Spletzer, Judy Stanley, and Karen Keese is pleased to present the following candidates for TAAS officership in 2003. The Committee is confident that these individuals will carry on the work of our Society with intelligence, good judgment, enthusiasm, and dedication to our mission of public astronomy outreach.

President – Ray Collins  
Vice President – Dale Murray  
Secretary – Elizabeth Burki  
Treasurer – Dave Brown

**PROXY BALLOT**

I,____________________________________________, a full member with voting privileges of The Albuquerque Astronomical Society, hereby authorize Ray Collins to cast my vote at the January 18, 2003 annual meeting of The Albuquerque Astronomical Society or any subsequent date to which this meeting is rescheduled. This Proxy Vote shall apply to all matters that come before said meeting, including but not limited to the electing of officers for the corporation.

Signed:__________________________________________ Date:________________________

(Please print your name in the first blank, and sign and date this form before submitting it.)
Classified Ads

Editor's Note
Please note that the deadline for the February 2003 issue of The Sidereal Times will be Friday, January 3rd, as the finished manuscript must be at the printers on Monday, January 6th so that you will receive it by the following Saturday. My e-mail address is editor@taas.org.

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 Barry Spletzer at telescope_loans@taas.org or 294-4601 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.

SOCIETY STAFF

<table>
<thead>
<tr>
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<th>E-mail Address</th>
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<td>299-4686(H)</td>
<td><a href="mailto:Larry@taas.org">Larry@taas.org</a></td>
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<td>294-4601(H)</td>
<td><a href="mailto:Barry@taas.org">Barry@taas.org</a> <a href="mailto:telescope_loans@taas.org">telescope_loans@taas.org</a></td>
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<tr>
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<td>821-1640(H)</td>
<td><a href="mailto:Chris@taas.org">Chris@taas.org</a></td>
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Events Coordinator | Vacant | events_coord@taas.org |
Education Liaison/TAAS Web Master | Sammy Lockwood 275-0258(H) | educat0n_coord@taas.org webmaster@taas.org |
TAAS Archivist | Pat Appel 292-0463(H) | archivist@taas.org |
TAAS Librarian | Dawn Gray 856-2054(H) | librarian@taas.org |
ATM Coordinator | Michael Pendley 296-0549(H) | atm@taas.org1 |
UNM Campus Observatory Coordinator | Jay Harden 296-0537(H) | unm_coord@taas.org |
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Explorer Post 110 Advisor | Mark Kroska 884-9108(H) | post110_advisor@taas.org |
Backyard Astronomy | Ryan Gray 856-2054(H) | backyar@taas.org |
MEMBERSHIP: You may request a membership application by sending e-mail to membership@taas.org or calling (505) 254-8227. Applications may also be downloaded from the Web site. Annual dues to The Albuquerque Astronomical Society are $30/year for a full membership and $15/year for a full time student (high school or less) membership. Additional family members may join for $5/each (student and family memberships are not eligible to vote on society matters). New member information packets can be downloaded from the website or requested from the TAAS Membership Services Director at membership@taas.org. You may send your dues by mail to our newsletter return address with your check written out to The Albuquerque Astronomical Society or give your check to the Treasurer at the next meeting.

MAGAZINES: Discount magazine subscriptions to Sky and Telescope and Astronomy as well as discounts on books from Sky Publishing Corporation are available when purchased by TAAS members through our society. Include any of the above magazine renewal mailers and subscription payments as part of your renewal check. Make checks out to TAAS (we will combine and send one check to the publisher). Warning: publishers take several months to process magazine subscriptions.

ARTICLES/ADVERTISEMENTS: Articles, personal astronomical classified advertisements and business card size advertisements for businesses related to astronomy must be submitted by the deadline shown on the Society calendar (generally the Saturday near the new Moon). Rates for commercial ads (per issue) are $120 per page, $60 per half page, $30 per quarter page, $7 for business card size. The newsletter editor reserves the right to include and/or edit any article or advertisement. E-mail attachments in Microsoft Word, 10 point Palatino, justified, no indent at paragraph beginning, one space between paragraphs is preferred. ASCII and RTF are acceptable. One column is approximately 350 words. Contact the Newsletter Editor at editor@taas.org for more information.

CHANGE OF ADDRESS: Note that The Sidereal Times is mailed at a nonprofit organization bulk mail rate. As a result, the newsletter will NOT be forwarded to your new address should you move!! Please provide the Treasurer (treasurer@taas.org) with your new mailing address to ensure that you receive your newsletter.

TAAS LIBRARY: Please contact the Librarian at librarian@taas.org or 856-2054 to check out a book or make a contribution.

TAAS on the World Wide Web: http://www.taas.org taas@www.taas.org

Map to Regener Hall (not to scale)

The Albuquerque Astronomical Society

P. O. Box 50581
Albuquerque, NM 87181-0581