GNTO News & Views

Peter Eschman

Our April 5th GNTO event was shortened for most of us by high winds. We had a great view of a rather spectacular fire in the Rio Grande bosque area to the southeast of GNTO. The sky was red with firelight and flames could be seen high in the air at times. Despite the windy conditions, Mark and Elaine Kroska, along with Rebecca Purvis managed to get a lot of telescope mount configuration and imaging done with the C-11 and Losmandy. I’m told they kept at it until dawn the next day. The other 8 folks gave in to the windy conditions and packed it up well before midnight.

As I mentioned in the previous newsletter article, we had a successful work party on March 16th, when we dug a new trench and installed conduit between the Ortega Building and the main dome. The 17 volunteers made quick work of the excavations, which marked the first phase of our efforts to relocate the solar modules to the roof of the Ortega Building. On April 19th we had a second work session to move the modules to their new location. The seven volunteers this time included David Blair, Larry Cash, Ray Collins, Mark Kroska, Dale Murray, Gordon Pegue and yours truly. I had stopped by David’s company (UniRac) the day before to load the donated mounting racks.

Under David’s excellent supervision, we managed to produce the new mounting racks installed and all 6 of the existing solar modules moved to the new location. We also mounted two new modules that had been purchased recently, to bring the full complement up to 8 modules. Each module is rated at 75 watts, so this improved capacity will help us recharge the battery bank much sooner and will increase our overall energy budget by a considerable margin. The modules are mounted at a much better angle, and will produce considerably more power than before. We would like to extend a grateful thanks to David and UniRac for their help in underwriting this improvement. On April 26th I met Joel C. de Baca (Matador Electric) and David Wilson (Zephyr Electric) around noon at GNTO. Joel and David donated their labor and considerable expertise to help wire the newly configured solar modules. David and Joel went one step better, and managed to get Summit Electric to donate all the materials necessary to complete the job. Summit has now donated materials in excess of $600 to help us get the job done.

We would like to thank Mr. Victor R. Jury Jr., the president of Summit Electric Supply, for his generous support of TAAS and GNTO.

Now that the solar modules are off the main dome roof, we can proceed with plans to renovate the roof decking of the main dome. We will issue a call for...
President’s Message

Ray Collins

Fire and Ice

Some say the world will end in fire;
Some say in ice.
From what I’ve tasted of desire
I hold with those who favor fire.
But if it had to perish twice,
I think I know enough of hate
To know that for destruction ice
Is also great
And would suffice.

— Robert Frost

I came across this sparse, laconic poem many years ago, and have marveled from time to time at its compression and dark humor. (Humor? More serious scholarship notwithstanding, the last two unemphatic lines have always impressed me as the sort that Frost would deliver with a chuckle, à la Ogden Nash. Then too, I am reminded of the limerick form, where the third and fourth lines are similarly shortened.) At a symbolic level, I have assumed that “world” in Fire and Ice spoke of either the human condition or some personal relationship in which the poet had struggled. I have never seen the contrast of “desire” and “hate” as parallel to the antagonism of fire and ice; that is as far as I’ve gotten with this poem in the past four decades.

Since Dante’s inclusion of a hell-bound frozen lake in his Inferno, replete with sinners frozen up to their necks, “fire and ice” has been an icon in literary works for two bad choices, usually offered as punishment. In describing nuclear winter (ice) as the no less terrible fate awaiting the survivors of nuclear war (fire), Carl Sagan made conscious use of the Fire and Ice theme. Occasionally, I have found Frost’s poem included as a literary fore piece or addendum in astronomy articles dealing with the planet death, star death or, ultimately, the fate of the universe.

A decline in the solar flux of just a few percent might plunge Earth into an unendurable ice age, as might the perturbation of Earth’s orbit by a stellar interloper. Otherwise, what most certainly awaits us, some 5 billion years in the future, is a fiery end when the sun’s outer layers bloat out past the orbit of Venus. A bantamweight star will become a black dwarf, a cold cinder, given sufficient tens of billions of years, whereas a truly massive star utterly blows itself up after a mere few hundreds of million years in a gloriously hot supernova explosion. If the universe possesses enough mass, and the modern notion of accelerating expansion is disproved, then the universe will end very dramatically when all of its matter comes back together in the Big Crunch (or Gnab Gib!). If the universe proves itself to be unbounded, then expansion will continue endlessly as stars die, galaxies grow distant from one another beyond all reckoning, and normal matter decomposes into a very thin and cold particle soup. (This eventuality gets my vote for the more depressing alternative.)

Tomes of literary analysis have been written on Fire and Ice, with a great deal made of Dante’s nine circles in the Inferno (nine lines in the poem, right?), and the assertion that sins of reason (ice) merit greater punishment than sins of passion (fire), a classification Dante apparently adopted from Aristotle. No fan of the pedants who dissected his poetry for layer after layer of symbolic meaning,

Robert Frost was never forthcoming with helpful hints for the interpreters. Had he been asked directly, he would have been quite capable of responding, “Who is Dante, anyway?” Some have even doubted that he ever read The Divine Comedy (although he owned a copy.) Could Fire and Ice be a rather naive little poem inspired by astronomy?

Harlow Shapley, a pre-eminent American astronomer at Harvard in the first half of the last century, made a respectable deduction of the size of the Milky Way Galaxy, using RR Lyrae stars to plot the positions of our galaxy’s globular clusters, and placing the galactic at the center of the swarm. Well into his dotage, Shapley was fond of recounting an encounter with the poet at a faculty dinner at Harvard, several years before the publication of Fire and Ice. In a forthright and persistent manner, Robert Frost asked how the world would end, and Harlow described the alternatives of fire and ice, with some supporting science instruction. “This personal anecdote,” Shapley concluded, “illustrates one of the many ways in which scientific knowledge can influence the creation of a work of art and also elucidate the meaning of that work of art.” [Brooks, Cleanth. Modern Poetry and the Tradition. New York: Oxford UP, 1965.]

Now, since the subject of the limerick came up earlier, let me lighten the mood with one that was a winner in a limerick contest for readers of the American Physical Society News (On-line) in 1997:

A Brief History of Gravity

It filled Galileo with mirth
To watch his two rocks fall to Earth.
He gladly proclaimed,
"Their rates are the same,
And quite independent of girth!"

Then Newton announced in due course
His own law of gravity’s force:
"It goes, I declare,
As the inverted square
Of the distance from object to source."

But remarkably, Einstein’s equation
Succeeds to describe gravitation
As spacetime that’s curved,
And it’s this that will serve
As the planets’ unique motivation.

Yet the end of the story’s not written;
By a new way of thinking we’re smitten.
We twist and we turn,
Attempting to learn
The Superstring Theory of Witten!

Bruce Elliott
May 17 General Meeting

Mars Is Coming!

Dr. Sara Schechner, the David P. Wheatland Curator of the Collection of Historical Scientific Instruments at the Department of History of Science at Harvard University, spoke at the April General meeting in the Lodestar Planetarium on the history of the sundial and its relation to social change, “Sundials, Science and Social Change.”

Science is influenced by the social demands and mores in place at the time. In turn, science affects society by changing its expectations and views of itself. We rationalize our fixation with technology and gadgets by saying that they “improve” our lives. Sometimes this is true but often acquisition of these objects is merely for conspicuous consumption or to prove that if you can work the thing you must be pretty smart!

The Egyptians used sundials as early as 1200 B.C. The first instruments were sticks that served as a gnomon to cast a shadow on the ground. The early Greeks and Romans used sundials first to mark the seasons and equinoxes. People in rural areas had little use for time keepers but in the cities they evolved into social tools to coordinate meals and prayer as well as other religious, military, and business activities. “Embodying principles of mathematics, astronomy, cartography and gnomics, sundials were used to find hours of the Divine Office, dates of Easter and movable feasts, and the way to Rome and Jerusalem.” They enabled merchants and the military to coordinate activities accurately in various locales that might have differed in latitude and sun time. Eventually sundials were finely crafted of precious materials and displayed more functions than most of the people who owned them needed or could use. They had become the 17th Century equivalents of the present day Rolex watch and PalmCorder!

Part of the evolution of the sundial was influenced by the invention of the clock in the 13th Century. For instance sundials could measure time by the quarter-hour when most clocks only indicated the hour and were extremely inaccurate. Eventually the accuracy, low cost and convenience of clocks displaced the use of sundials until now sundials are looked upon as decorative curiosities by most persons.

The general meeting and lecture were followed by a coffee-cookie social hour. Later on several TAAS members reconvened at the Rio Grande Flying Star for an impromptu star party with the guest speaker and her daughter, Naomi.
**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](http://www.stardate.org)

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**June 2003**

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**Sunrise/Sunset**

- 6/1 04:53/19:16
- 6/15 04:52/19:23
- 6/30 04:55/19:25

**Planet Rise / Set (6/15/2003)**

- Mercury 03:39/17:35
- Venus 03:44/17:53
- Mars 23:22/09:58
- Jupiter 08:48/22:36
- Neptune 22:19/08:42
- Saturn 05:25/19:49
- Uranus 23:24/10:25

Important Notice to All Members Concerning TAAS’s Sidereal Times Newsletter

Did you know that $20 of your $30 membership dues is spent on annual printing and mailing costs for the TAAS Sidereal Times newsletter? That’s right, only $10 of your annual dues is left over to fund all of TAAS’s programs and other expenses, including the General Nathan Twining Observatory, Educational Outreach programs and Special Events, etc. Current TAAS expenses, including programs and printing costs, equal $38 per member, per year. You can help reverse TAAS’s spending dilemma without impacting the newsletter or our important programs. By getting your monthly TAAS Sidereal Times Online, instead of in your mailbox, you can help keep TAAS funds where they belong: in TAAS Programs.

- Online newsletters are available many days before a printed version arrives in the mail.
- Online newsletters bring you beautiful high resolution color pictures and graphics.
- The online hi-resolution version is the exact copy that is sent to the printers for mailing.
- A low-resolution online version is also available for faster download.
- The lo-resolution version is identical except the pictures and graphics are slightly less detailed.
- Online newsletters save TAAS funds for use in our important programs and are environmentally friendly by reducing our use of paper.

To take advantage of the beautiful online version of the Sidereal Times, send an email to Dave Brown at treasurer@taas.org, verifying your current e-mail address and letting him know that you would like to begin using an online newsletter instead of the printed version. You will then receive a monthly e-mail notice when your online newsletter is available. Members who use the online versions of our newsletter will greatly help TAAS maintain its commitment to quality programs for its members, the general public, and the children of New Mexico.

Thank You,
Sammy Lockwood, Web Master.
Dave Brown, TAAS Treasurer.
**July 2003**

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**AMATEUR TELESCOPE MAKING 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, May 17th**

**7:00 P.M.**

**Subject:**

**Mythology of Mars**

**Speaker:**

Monica Cyrino, Ph.D

**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.
Minutes of the Board of Directors Meeting

Elizabeth Burki


I. Corrections to minutes: Shannon Mann was voted on as a Member-at-large

II. Treasurer’s Report: Summary report distributed. Insurance fee paid. We are still above budgeted membership in dues. A bill of sale and donation of 16” telescope is being prepared. David Brown will be sending in astronomy magazine subscriptions. Discounts are available to TAAS members. The Explorer and Boy Scout Fund accounts will be combined.

III. Correspondence: Karen Keese and Neil Goldberg submitted Minutes of the Astrophotography Committee meeting. August 13th is the deadline for submissions with judging in September. Prize monies suggested: 1st prize = $50; 2nd prize = $25; 3rd prize = Certificate. Winner will be asked to donate a copy of the picture to LodeStar.

IV. Retrospect: Last meeting Barry Spletzer and Barry Gordon thought the last meeting was excellent. On 3/17/03, 17 people showed up at GNTO to dig a trench and clean up for the picnic. 27 people participated in the picnic with 10 – 12 people coming for GNTO training. 36 people participated in the Messier Marathon. Two participants found 108 objects. 94 objects found by imaging crew. Barry Spletzer is considering developing a summer marathon. Bandelier Elementary school program worked out well, even with low student turnout. Truman Middle School cancelled. On 4/5/03 Becky Purvis and Mark Kroska worked on the polar aligning of the Isengard telescope through the night and taking images into the dawn.

V. Prospect: Next general meeting will be held at LodeStar. Karen Keese will provide coffee. TAAS members are requested to bring goodies. GNTO viewing will be on 4/26/03. The last star parties of the year will be at Sandia Prep on 4/29/03 and Dennis Chavez on 5/02/03. Larry Cash has taken ownership of the Oak Flat Evening. The Lunar Eclipse Fiesta will be held at the Yale Observatory on 5/15/03. Barry Gordon has contributed useful astrophotography information on the Web site.

VI. Committee Reports:

a. Membership: No report
b. GNTO: Pete Eschman reports that the last of the Intel Grant monies have been spent on a video monitor for GNTO. Some overage costs were taken out of the regular GNTO capital improvement monies. Pete suggested contacting Intel for additional funds to build on existing video equipment, low level lighting for the 10-foot dome and improvements to the Isengard. He asked permission to spend $120 for a power adapter because of problems with the power supply. Approval granted. Pete requested permission to purchase a 9” gear and worm assembly for $736.00 from Opticraft. Expenditure approved. Upcoming GNTO work includes moving the solar modules and repairing the dome decking. The completed screen saver project CD will be demonstrated at the LodeStar meeting. Because it is a State facility no sales can be made on site. The cost of each disc is $20. and they can be ordered through the web site. Marketing strategies for local, state and national markets was discussed. Some of the proceeds from the sale of the screen saver will go to paying off the remaining $550 balance for equipment and other purchases.

c. Education: no report
d. Grants: Meade has donated an ultra-wide angle (6.7 mm) eyepiece. It will be placed on the C5 telescope

VII. Old Business:

a. Astronomy Day: Karen Keese has been busy coordinating vendors, working through the maze of city ordinances and generally working hard to make the day a success for TAAS and for LodeStar. Dale Murray will coordinate power requests/requirements for the event. Allan Hale (of Hale-Bopp fame) will be attending the event.

b. Youth Outreach Task Force: no report

c. Board of Directors Official e-Mail, not the List Serve should be used for upcoming events. Every member should be receiving updates. Pete needs a copy from members sent to him by Wednesday to make sure that events will be covered.

d. Ray Collins reported that Dale Murray and Bruce Levin will present awards at the Science Fair.

c. 30 members have already signed up for the electronic newsletter.

d. Becky Purvis suggested that we sell astronomy photographs or a TAAS calendar to generate additional funds.

Meeting adjourned at 8:30 P.M.
In Search of Alien Oceans
Patrick L. Barry and Dr. Tony Phillips

A robotic submarine plunges into the dark ocean of a distant world, beaming back humanity’s first views from an alien ocean. The craft’s floodlights pierce the silty water, searching for the first, historic sign of extraterrestrial life.

Such a scenario may not be as fantastic as it sounds. Many scientists believe that Jupiter’s moon Europa conceals a vast ocean under its icy crust. If so, heat from the moon’s interior—which would keep the ocean from freezing solid—may also drive subaquatic volcanoes and hydrothermal vents. On Earth, such deep-sea vents provide chemical energy for ecosystems that thrive without sunlight, and some scientists even suggest that Earthly life first got started around these vents.

So a warm Europian ocean spotted with thermal vents could be a natural incubator for life. That’s why some scientists hope that someday we will send a probe to Europa that could bore through the ice and explore the ocean below like a submarine.

To plan for such a mission, scientists would first need to put a camera in orbit around Europa. By looking for places where water has welled up to fill the spindly cracks that riddle Europa’s surface, scientists can estimate where the ice is thinnest—and thus easiest to bore through.

That mission scenario presents a problem, though. Europa orbits Jupiter inside the giant planet’s punishing radiation belts. Continuous exposure to such high radiation would damage today’s scientific cameras, making the information they gather less reliable and perhaps ruining them completely.

That’s why NASA is designing a more radiation-tolerant CCD that could be used on a mapping mission to Europa. A CCD (short for “charge-coupled device”) is a digital camera’s chip-like core, which converts light into electric signals.

“We’ve seen the effects of this radiation during the Galileo mission to Jupiter,” says JPL’s Andy Collins, principal investigator for the Planetary Imager Project. “Galileo has orbited Jupiter for many years, dipping inside the radiation belts only for brief intervals.” Even so,” he says, “we’ve seen clear signs of damage to its instruments.”

By using the hardier CCD’s developed by the Planetary Imager Project, a future probe could remain in Jupiter’s radiation belts for many months, gathering the maps scientists will need to finally get a peek behind Europa’s icy veil. And who knows, maybe there will be something peeking back!

To learn more about the Galileo mission to the Jupiter system, visit http://www.jpl.nasa.gov/galileo/. For children, a fun, interactive “Pixel This!” game at http://spaceplace.nasa.gov/p_imager/pixel_this.htm introduces CCDs and how a really tough one will be needed for a future mission to Europa.

Cracks on the icy surface of Jupiter’s moon Europa give evidence of a liquid ocean below.
The roof workers under David B.’s direction set the first module, left to right: Dale, David B., Mark, Larry, Ray. Adapting the new modules to fit with the old, clockwise from left: Ray, Larry, David B., Dale, Mark. The modules in their new location and orientation at the end of the work session.

Joel pauses for the camera. Joel and David W. plan out the hardware. David W. puts up with the wind to get the job done. David B. checks out the work topside while Joel secures one of the electrical boxes.


volunteers to assist in the roof work that is currently slated for later this month and next month. As the afternoon of April 26th faded toward evening, a whole host of folks showed up for the evening observing session. Viewing conditions were fairly good, but somewhat breezy throughout the night. We had over 40 people in attendance, and over 15 telescopes in action that evening. Karen Keese introduced a number of newcomers to the use of the Isengard, while Mark Kroska gave a series of imaging demonstrations and informal instruction sessions on the art of CCD imaging. Judy Stanley brought a number of guests, including some of her UNM student staff, and the Clark family. Everyone seemed to have a great time.

Our TAAS screensaver had its rollout debut at the general meeting at Lodestar on April 12th. The working group that produced the screen saver included Mark Kroska, Larry Cash, Karen Keese and Gordon Pegue. This very professional product is now available for purchase at a very reasonable cost of $20, so please check our web site for details. Proceeds of the sale of the screen saver go to TAAS, and TAAS members contributed all the images. Mark Kroska did the bulk of the work preparing images, using software donated by Dan Richey to create the final product. Alison Schuler provided much valuable legal advice and Charlie Dodge’s company, Gamma Tech, provided slide transfers. David Blair, Nancy Davis, Carl Frisch, Barry Gordon, Dan Richey and John Sefick contributed wonderful images. Thanks to all who helped with this project!

Our next training session is scheduled for May 24th. Training will cover all of the equipment used at GNTO, from the Isengard 16” reflector to our computers and the C-11/ST-9E CCD camera imaging system. We will also provide an introduction to the two loaner scopes that are available at GNTO. The loaner telescopes include 6” and 16” dobsionian mounted reflectors. The CCD imaging training session will go as far into the evening as students are willing to listen, learn, and take their own images. If time permits, we will offer an introduction to our new Stellacam EX astro-video equipment. Be sure to mark your calendars now for this opportunity to learn about your observatory and enjoy the relaxed company of fellow observers. Our next “new moon” observing opportunity at GNTO is on June 28th. This promises to be a good night since it is only one day before the new moon. We have some great equipment on hand for you to use, so I hope you can join us.

GNTO committee meetings are open to all interested TAAS members and our next scheduled meetings are May 8th and June 5th. As usual, these meetings are on Thursday, 9 days before the TAAS general meeting. We meet at 6:30 P.M. at JB’s Restaurant on the southeast corner of San Mateo and Montgomery. If you have questions about access and availability of GNTO, please contact me (Peter Eschman, gnto@taas.org, home phone: 873-1517, work phone: 277-0020.) I hope to see you soon at our observatory.
Dr. Mark Mulrooney, former project scientist for the now-dismantled Liquid Mirror Telescope in Cloudcroft, stands next to the 6-meter Liquid Zenith Telescope being developed at the University of British Columbia. The LMT lives on, as its prime focus assembly is being incorporated into the LZT.
Red Moon on May 15

On Thursday May 15, local residents will gather with TAAS astronomers at the UNM campus observatory for a viewing of this month’s total lunar eclipse. Join us, and bring your friends and family as we enjoy the beauty of a Red Moon on a warm night in May.

Totality lasts from 9:14 P.M. until 10:07 P.M.. The next total lunar eclipse is on November 9, 2003.

The UNM campus observatory is located on Yale NE, just north of Lomas. Details for the event, and maps to the observatory are located at www.taas.org

Difficult to see — even though Mars will be just about as close and bright as it ever can get. Therefore, binoculars or telescope would really be desirable for this one. (Mars, as noted, being unusually close, even modest telescopes should show it as a reddish disc, and possibly even reveal faint greenish markings.) Closest approach, the Moon’s edge just barely missing Mars, will be about 2 in the morning of July 17.

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TAAS and the LodeStar Astronomy Center are sponsoring the second annual “Astro-Images of New Mexico: Portraits from the Foothills of Space” photo contest and exhibition. The deadline for entries is August 13, 2003. Entries will be judged by a panel of five judges. Contest judges are:

- David Nelson Blair - author and technical writer, and past president of TAAS. An avid amateur astronomer and film photographer, he first photographed the stars in 1970.
- Tom Brahl - commercial film and digital photographer for 20 years, specializing in editorial and public relations photography for educational institutions in New Mexico. His work has appeared in numerous publications and ad agency campaigns.
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Corporate sponsors and contest prizes will be announced at a later date. For contest details and an official entry form, go to www.taas.org/astroimages.html.

On the night of July 16/17, the Moon will pass very(!) close to the planet Mars. Since the Moon (ie, the side facing us) will be more than three-quarters sunlit, its glare might make the planet somewhat
difficult to see — even though Mars will be just about as close and bright as it ever can get. Therefore, binoculars or telescope would really be desirable for this one. (Mars, as noted, being unusually close, even modest telescopes should show it as a reddish disc, and possibly even reveal faint greenish markings.) Closest approach, the Moon’s edge just barely missing Mars, will be about 2 in the morning of July 17.

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TAAS Educational Outreach Tops 4000

TAAS’s Educational Outreach Program for the 2002-2003 school year has concluded, and by all accounts, it has been the most ambitious and successful year ever. This year over 4000 kids, parents and teachers have enjoyed TAAS efforts at 18 separate events from 33 docent instructors. TAAS Outreach docents were recognized at our general meeting on May 17, and awards were presented to several.

If you know of anyone who attended a TAAS Educational Outreach event for 2002-2003, and is not listed below, please contact sammy@taas.org

Year End Wrap-up:
Changes were made in this year’s Outreach program, that allowed our efforts to be more easily incorporated into each school’s schedule. Schools were encouraged to schedule our astronomy nights in conjunction with an open house or a science fair. This resulted in a wider variety of exhibits, and greater turnouts. In addition, Friday TAAS daytime shows were added, which complemented regular classroom schedules.

For 2002-2003, TAAS’s Outreach programs were presented at:

1. Isleta Elementary
2. Bosque Prep School
3/4. Griegos Elementary
5. Hoover Middle School
6/7. Sierra Vista Elementary
9. Collet Park Elementary
10. Eldorado High School
11. Eastern Hills Christian Academy
12. Bandelier Elementary
13. Manzano Day School
15. Cub Pack 389
16. Onate Elementary
17. Sandia Prep School

Detailed wrap-ups of each event are at www.taas.org/education/

TAAS Outreach Docents for 2002-2003 included:

Rodema Ashby
Judy & Mickey Bock
James Brockway
Eric Bucheit
Elizabeth Burki
Larry Cash
Joel C.de Baca
Ray Collins
Nancy Davis
Neil Goldberg
Barry Gordon
John Gould
Jay Harden
Gary Harms
Georgia & Bob Hufnagel
Elaine & Mark Kroska
John Laning
Sammy & Sheryn Lockwood
Moriah Lockwood
Sam Lockwood IV
Shannon Mann
Dale Murray
Brock Parker
Gordon Pegue
Rebecca Purvis
Mr. & Mrs. Conrad Sloop
Steve Snider
Barry Spletzer
Chris Wilson

TAAS Educational Outreach has benefited from several acts of kindness and generosity over the past year:

$25 - Sierra Vista Elementary
$70 - Proceeds from a bake sale held at Bandelier Elementary
$200 - TAAS member JoAnne Schiabor on behalf of Manzano Day School
$60 - Sandia Preparatory School
$40 - TAAS Outreach donation jar
Laptop PC, accessories, software - TAAS members Don and Rosemary Ditmore.

Generous folks like these enable TAAS Educational Outreach to offer quality programs. These donations will be used to replace and enhance our demonstration materials, including starlab and spectral analysis.

On behalf of TAAS Educational Outreach,

THANK YOU
Sammy Lockwood

Final Outreach Event Wrap-Ups
Sandia Prep 4/29 - In the morning, Chris Wilson and Brock Parker offered solar views to about 100 students.

Sandia Prep 4/29 - Our final scheduled scope event of the year was part of Sandia Prep’s annual science fair. TAAS docents braved high winds and clouds to offer about 200 students views and demonstrations. Barry Gordon offered his slide show while Sammy Lockwood manned the demonstration booth. Telescope views were provided by John Laning, Brock Parker, Jay Harden, Barry Spletzer, Rebecca Purvis, Bob Hufnagel, Chris Wilson, Mark Kroska, and Ray Collins.

Dennis Chavez 5/2 - Canceled due to illness.
From the Ivory Basement
8. A Universe of Mostly Unseen Color
Barry Spletzer

This month’s topic is color, specifically the colors we see (and don’t see) in the night sky. I have two reasons for this particular topic. First, is the usual astronomical curiosity about what’s up there in the sky. Second, since any discussion of color is vastly aided by some full-color illustrations, I am doing this to help encourage the vast members of my readership (both of them) to check out the full-color edition of The Sidereal Times available on the Web at www.taas.org. We encourage folks to opt for the Web version rather than the paper version both to allow the Society to spend its limited funds on other worthwhile pursuits and so our members can view a full-color high-resolution Sid Times.

As usual, there are a few background preliminaries that I need to cover. First, is that light, gamma rays, x-rays, radio waves, microwave radiation, ultraviolet, and infrared are all different names for different wavelengths of electromagnetic radiation. For the purposes of this article, I will talk about this in terms of wavelength. Most of the wavelengths are expressed in microns with 25,400 microns equal to one inch. To put in perspective, a hair is about 25-50 microns in diameter. Visible light ranges from violet (about 0.4 microns) to red (about 0.7 microns) and our local KOB radio station at 770 kHz broadcasts at a wavelength of about 1300 feet.

Next, is the fact that when anything is heated it emits electromagnetic radiation at all wavelengths but at very different intensities. An example of this is the heat you can feel radiating from a red hot object. As it turns out, up until 1900 no one had a suitable explanation for this everyday phenomenon. It was then that Max Planck, in a tremendous and vastly underappreciated feat, invented quantum theory to predict this radiation spectrum. His result matched precisely with observed data and today is the basis for our understanding in this area.

Figure 1 shows the amount of energy radiating at different wavelengths by bodies at different temperatures. As it turns out, the material that is heated is not important. All that really matters is the temperature. This means we can determine the temperature of stars by matching there color with a heated body on earth. I’ve chosen four temperatures in the figure corresponding to a red star like Antares or Betelgeuse, a yellow star like the Sun or Polaris a white star like Sirius or Vega, and a blue-white star like Rigel. At the bottom of plot is a rainbow (or a graybow for those of you reading the paper edition) that covers nearly the entire width of the plot. This is compressed down in the plot to show the true width of the spectrum of visible light. An interesting point is that only 1/3 of the Sun’s total energy is visible light. For red stars, only about 5% is visible light. The rest of the energy consists of invisible wavelengths, infrared for the longer wavelengths and ultraviolet for shorter ones.

This plot of star spectrum can be used to show the color of various stars. In Figure 2, I have blown up the visible section of the plot to compare the color of different temperature stars of equal magnitude. By examining this plot you can begin to see how different temperature stars have different colors. The plot for Antares shows that it emits more energy in the red wavelengths then in the blue ones, making star appear orange. The star will not appear...
pure red because along with the red wavelengths there are all other colors as well. It is just that the shorter (bluer) wavelengths aren’t emitted as strongly. Looking at the plot for the Sun, you see that the line is nearly horizontal meaning all colors are equally represented. This is our definition of white light. The hotter stars (Vega and Rigel) shine more strongly at the blue end of the spectrum. As it turns out, at some point the color doesn’t change anymore. As stars get hotter and hotter they shine more brightly but the ratio of the different color wavelengths stays the same so the color is the same.

One result of all this is that, for any star temperature, there is a specific color and the variety of colors is quite limited. Stars are divided into spectral classes by the temperature (or color) with each class been designated by letter. The letter designations from hot to cold are O, B, A, F, G, K, M and R although you seldom see the R designation or for that matter R class stars. Even M class stars are relatively dim. For stars of equal size and distance from us, a B class star is about 20,000 times (11 magnitudes) brighter than an M class.

Figure 3 shows a triangle that contains all of the shades of color possible on a computer monitor. Inside this triangle there is a curved black line that passes through all the possible colors of stars. Along the line I’ve labeled the star class corresponding to the color. At the top of the figure is a black band showing the color of a star of each class along with the class designation and the temperature in degrees Kelvin. As you can see, the variety of colors available is quite limited. Basically, orange, yellow, white, and blue-white pretty much covers the range of available colors for stars.

Among deep sky objects, galaxies, open clusters and globular clusters consists of stars. For objects with large numbers of stars (galaxies and globular clusters) the spectra of the various stars merge together to give the typical white color. Some galaxies have regions of color caused by a higher density of stars of a single class usually concentrated in the center.

For the other deep sky objects, planetary and diffuse nebula, the colors are generated in a completely different manner. Rather than if hot bodies emitting light at all wavelengths, these nebulae consists of clouds of gas where individual atoms are excited by the absorption of high-energy (usually ultraviolet) light. When the atoms return to the unexcited state they give off light of a very specific wavelength. Although there are many different types of atoms each emitting at one or more wavelengths, for most nebulae only two makes a most of the visible light. These are hydrogen and oxygen. In hydrogen, this emission is called H Alpha with a wavelength 0.656 microns (red) and the oxygen emission is O III at 0.500 microns (blue-green). The relative amount of H Alpha and O III emission determines the color of the nebula. Figure 4 shows the range of colors possible by the combination of these two wavelengths. The possible colors range from red to pink to white to blue-green. If you look at pictures of nebulae you will find that they primarily display colors shown in the figure.

So far, I have been talking about the colors that are in the sky. These can be quite a bit different from the colors that we see. The perception of color is quite complex and not entirely understood. It is known that we have two separate types of light sensors in our eyes, rods and cones. The rods are very sensitive to light but cannot distinguish color. The cones are less sensitive to light but can detect colors.
Because of these two types of sensors and the difference in sensitivity we can only detect colors when the light is fairly bright. This is why, during dusk, colors fade until everything looks gray. This is also why there are very few colored stars visible to the naked eye while in a telescope they are common. By gathering more light, a telescope increases the apparent brightness of the star which allows us to see the colors that are there. As with naked eye viewing, in the telescope stars that appear dim are too dim for us to see the color.

This is also why most nebulae appear colorless in the telescope. The surface brightness is just too low to stimulate color vision. One exception to this is some planetary nebulae which have unusually high surface brightnesses. These planetary nebulae appear quite blue. Some examples are the Blue Snowball and NGC 6210. The blue color means that we are seeing the O III emission. The color sensitivity of our eyes is much greater for O III (blue-green) than for H-Alpha (red) so we never see red nebulae in our telescopes. In photographs the case is quite different since the red sensitivity tends the higher for photographic systems and the time exposure allows the apparent brightness to be greatly increased. Most diffuse nebulae such as the Horsehead, Lagoon and Orion’s Nebula are very red in photographs. One example that shows most of the possible colors of a nebula is the Trifid (M20). Photos of the Trifid show red, pink, white and blue. This is about his colorful as any deep sky object gets.

Summing it all up, the variety of colors available in the sky are fairly limited and totally predictable and even though there are colors out there, it requires considerable brightness before we can see them. This doesn’t mean that colors are not worth looking for, only that you need to know what to expect. The colored doubles, Alberio and Gamma Andromeda, the Garnet Star (Mu-Cephi), the blue planetaries I mentioned before, and even the slight green tinge of the Orion Nebula are always worth taking a look at.

One final note: I have been writing this column for several months now on topics that interest me. If there are topics that you would like to see discussed here, I am open to suggestions. Please contact me via e-mail at barry@taas.org or see me at one of our TAAS events.

Mail

Whoever says Messier Marathons aren’t a right of passage is obviously wrong. Having completed my first this year, I feel as though I’ve been inducted into a club even crazier than the Polar Bear club. I had expected, frankly, a night of ease and merriment. I imagined myself flitting from telescope to telescope, feasting my eyes on the flourishing arms of spiral galaxies and the astounding shapes of nebulae. Inside, if I felt the need to replenish my waning stores of toastiness and warmth, a different sort of feast would be waiting for me: heaps of delicious and hearty morsels.

The night wasn’t exactly easy, to be sure. And the only flitting I did was from my telescope to the computer. Replenishing the stores of toastiness and warmth was a futile endeavor from the beginning. As for the heaps of delicious and hearty morsels, I’m sure they were very delicious and hearty, but within seconds after sunset, my taste buds were frozen.

By the end of the night I was so tired every star looked like a nebula. I felt as if I had been running laps for an eternity (to the car to check the computer program, back to the telescope to refine the alignment, back to the car again…). Furthermore, I was so cold it seemed as if I had been running those laps at the North Pole wearing the Emperor’s new clothes.

Barry was fine. Barry was a rock. Barry just stood by while I grumbled about how it was remotely possible for Messier to mistake some of these objects for comets even with his crude refractor. A double star? Charles, what were you thinking? Barry patiently guided me through the notorious Virgo cluster. That was the low point of the night. So many galaxies out in the middle of absolute nowhere. I was positive that some unseen hand was rearranging them into new configurations every time I looked away. I still am positive. There was NO other way, because I was moving my scope EXACTLY how Barry said to. And no matter HOW many times I started over— Make no mistake, the night was excruciating. I’m sorry did I say excruciating? I meant exhilarating. No, really, it was. What more than made up for the pain was that in one night I saw close to one hundred objects, all different, all astonishingly beautiful, though some were little more than miniscule smudges. The Messier Marathon is aptly named as it is similar to running an actual marathon. But while there are 26 miles in a regular marathon, there are millions of light years in the Messier marathon. And while running in a regular marathon offers views of the road and other mundane vistas, the Messier Marathon selects the crème de la crème of our galaxy and beyond for the marathoner’s viewing pleasure. And ultimately, with all the griping above said and done, viewing pleasure it was.

The mechanism of seek and find was enormously satisfying. It was as though the night sky was a gigantic mine filled with diamonds, but there was a map. And the map wasn’t just any map, because it told you where the diamonds were, but not how to find them. For instance, the computer would show an object in Hercules. It was up to the finder to say, “right, if I make a 30-60-90 triangle with those three stars, the object is halfway up the hypotenuse” or some such thing and then find the actual stars in the actual sky. Here is where the metaphor breaks down, because having found the diamond, the next logical step would be to take it home. Instead, I took home a tired Judy and a crumpled list scattered with checks. I also took home the kindness of many people. I would like to say thanks to everyone who helped me, most notably Judy and Barry, who were wonderfully patient and supportive the entire night.
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Editor’s Note

Please note that the deadline for the July 2003 issue of The Sidereal Times will be Friday, May 30th, as the finished manuscript must be at the printers on Monday, June 2nd, so that you will receive it by e-mail that day or by s-nail mail the following Saturday. My e-mail address is editor@taas.org.

Free Telescope Offer

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