

OBSERVER

COMETARY COMMENTARIES

CELESTIAL RENDEZVOUS

C/2011 L4 PanSTARRS passed M31 on its way to Cassiopeia in morning twilight at 5:30-5:35 A.M. As usual, the comet proved elusive in our hazy, twilight Colorado spring skies until just before it disappeared from view. On page 7 of this issue is an interesting and thought-provoking "Letter to the Editor" regarding comets in general. This image was made at the EGK Dark Site on April 4, 2013. Darrell used a Modded Canon 450D through Pentax 135mm SMC f/2.5 lens. Stack of 10 images, 20-40 secs at f/2.5 ISO 400.

Image © 2013 Darrell M. Dodge

Calendar

2.....	Last quarter moon
9.....	New moon
17.....	First quarter moon
24.....	Full moon
31.....	Last quarter moon

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MAY SKIES

by Dennis Cochran

Photo-op alert: Sunday, May 26th—Mercury, Jupiter and Venus will be conjunctifying in the sunset west-northwest. On that same day in 1961, President Kennedy announced the goal of putting a man on the moon. Three years earlier, shortly after Sputnik started the space age, a rocket engine made by a company I worked for was considered a success because it only blew up 20% of the time!

Much earlier in May, in the twilit morning of Monday the 6th, the Eta Aquarid meteors will scatter in the eastern sky. Farther south observers will get to see more of them before the sun rises to spoil the view. Meanwhile, stuff happens: The DAS Annual Banquet has been rescheduled for May 4.

The *May Sky & Telescope* has two articles in a row by Sue French and Alan Whitman about galaxies in widespread parts of Virgo, neither of which is the well-

observed M84, M86 and M87 area. Check these out before your sky-feast on a warm spring night. Imagine as you look at each galaxy that there might be people—of some sort—peering back at you and wondering if you are really there! Virgo is a largish constellation directly above Corvus and Crater that we talked about last month. Virgo's bright star Spica is just west of Saturn in a region that the moon will visit on the 21st and 22nd. Just east of the ringed planet, the scales of the constellation Libra are weighing stars. Actually the scales are being used by Astraea, the goddess of justice, and dangling down in the face of Scorpius who is struggling to rise in the southeast. If you can find ζ (sigma) Lib hanging from the western end of the scale's horizontal triangle, look west of it past an arc-of-stars asterism to find globular cluster NGC 5694 at 14^h 40^m and -26°.

Continued on Page 3

PRESIDENT'S CORNER

by Ron Hranac

Have you ever wondered about some of the really big and really small numbers that are part of astronomy? Grab a cup of coffee and follow along as I highlight the concept of big and small numbers.

In reality, it's hard to grasp just how big or small numbers can be. Consider the number 1,000,000. When discussing an electromagnetic signal such as a radio wave, 1,000,000 might be its frequency, as in 1,000,000 hertz (Hz).

If you were to count to 1,000,000, how long would it take? Assuming one second per number, and you count nonstop to 1,000,000, it will take a million seconds. That's just over 11 1/2 days. From that perspective, a million is a pretty big number. It's generally inconvenient to deal with large numbers like that, which is where the International System of Units (SI)—specifically SI prefixes—can help. Our 1,000,000 Hz frequency becomes 1 megahertz (MHz). For the curious, a 1 MHz signal falls in the AM radio broadcast band.

One measure that astronomers deal with is the speed of light. According to the National Institute of Standards and Technology, the speed of light in a vacuum, c_0 , is 299,792,458 meters per second. The designation c_0 is one that NIST uses to reference the speed of light in a vacuum, while c is occasionally used to reference the speed of light in some other medium. The subscript zero often is dropped, with c being a generic designation for the speed of light.



Let's put c_0 in terms that may be more familiar. You probably recall from science class in school that the speed of light is about 186,000 miles per second. Sorting out a more precise number: $299,792,458 \text{ meters per second} / 0.3048 = 983,571,056.43$

feet per second, and $983,571,056.43 \text{ feet per second} / 5,280 \text{ feet per mile} = 186,282.397 \text{ miles per second}$. What's that in miles per hour? $186,282.397 \text{ miles per second} * 60 \text{ seconds} * 60 \text{ minutes} = 670,616,629.39 \text{ mph}$.

That's really, really fast. How fast? Imagine a beam of light that could somehow travel unimpeded around the Earth's equator, a distance of about 24,900 miles. In one second, that beam of light will go around the Earth nearly 7-1/2 times!

How far will light travel in the blink of an eye? I've read that an eyeblink's duration can be as fast as 150 to 200 milliseconds (ms) with 200 to 400 ms perhaps more typical, but for this example let's call it 175 ms. In a blink of an eye, then, our light beam will have traversed 32,599 miles, or roughly 1-1/3 trips around Earth's equator.

How far does light travel through space in one year? The answer is about 5.879 trillion miles, which is called a light year. No, "light-year" isn't a measure of time, it's a measure of distance—A really long distance. Do you remember NASA's Voyagers 1 and 2 spacecraft from the 1970s? They're headed out of our solar system at about 40,000 miles per hour, give or take. At that speed, it will take 16,766 years to travel a distance of one light-year. If the Voyagers were headed directly to the nearest star beyond our solar system—Proxima Centauri, just 4.22



Continued on Page 4

DAS SCHEDULE

MAY

- 4 Annual Banquet Rescheduled: Page 6
- 5-6 Eta Aquarid meteor shower
- 10-12 EGK Dark Sky weekend
- 11 Space Day @ DMNS w/solar telescope viewing
- 18 Open House at Chamberlin Observatory (Begins at 8:00 P.M.)
- 24 General Membership Meeting at Olin Hall (Begins at 7:30 P.M.) Speaker: Tom Field: *Amateur Astronomical Spectroscopy*
- 31 E-Board Meeting at Chamberlin (Begins at 7:30 P.M.)

JUNE

- 4-8 Rocky Mountain Star Stare
- 7-9 EGK Dark Sky weekend
- 15 Open House at Chamberlin Observatory (Begins at 8:30 P.M.) Saturn!
- 21 General Membership Meeting at Olin Hall (Begins at 7:30 P.M.) Speaker: Doug Duncan
- 28 E-Board Meeting at Chamberlin (Begins at 7:30 P.M.)

Public nights are held at Chamberlin Observatory every Tuesday and Thursday evenings beginning at the following times:

April 9 - October 1 at 8:30 P.M.

October 2 - April 8 at 7:30 P.M.

Costs to non-members are: \$3.00 adults, \$2.00 children.

Please make reservations via our website (www.denverastro.org) or call (303) 871-5172.

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The Executive Board conducts the business of the DAS at 7:30 p.m. at Chamberlin Observatory. Please see the Schedule of Events for meeting dates. All members are welcome.

www.denverastro.org

MAY SKIES

(CONTINUED FROM PAGE 1)



SERENGETI MILKY WAY

Photo left: The Milky Way galaxy stands tall over the Serengeti in this view to the northwest from Ndutu. This view is about 110 degrees tall and 80 degrees wide in this 10-frame mosaic.

The Pleiades star cluster is just above the left edge of the large acacia tree, and above the Pleiades is the planet Jupiter. Just above the largest acacia tree, center, is a red smudge: that is the California nebula, NGC 1499. The constellation Orion is at the upper left edge and with Orion's belt nearly vertical. The three stars in the sword has the bright Orion nebula (M42) in the center of the 3 stars. The sword stars point toward the north celestial pole, which is 3 degrees below the horizon near the left side of the image. The bright star at the center near the top edge is Procyon, Alpha Canis Minor. The small star cluster to the upper right is M44.

The Milky Way Galaxy in this part of the sky is the faint part of the Milky Way, as we are looking away from the Galactic center. Toward the bottom of the image we see faint red and some green in the sky: this is auroral airglow. Visually, the northern horizon appeared bright, even though this is some of the most remote and darkest places on Earth. Lights from the Ndutu lodge illuminated the trees. For technical information, please see: <http://www.clarkvision.com/>.

side of the kite is ϵ (epsilon) Boo, a double star with orange and green components widely spaced. If you continue up that side of Boötes to δ (delta) at the eastern corner of the kite, and then go up a bit more northerly to the next star μ (mu) Boo, that, too, is a double, a fainter orange-white pair. Just east of μ (mu) Boo is a visual pair on the border of the Corona Borealis, or Northern Crown region, and east of that the brightest star in a small group is ζ (zeta) CrB, a wide-spaced blue-blue double.

Down deep in the cup of the Northern Crown, all alone and a bit left of center is R Corona Borealis, a famous carbon star that generates clouds of soot that change its spectrum, but not in a predictable pattern. The light-curve for this is shown on Page 200 of the 2nd Edition of *Peterson's Guide to the Stars and Planets*. Since it does not repeat we should say "a light curve," since the soot makes it always different from time to time.

Back at the top of Boötes again, find the right-hand corner of the kite— γ (gamma) Boo. One can trace this constellation off the kite north from γ (gamma) Boo past λ (lambda) Boo to where the Kappa-Theta pair make a sudden turn to the east. This is just northwest of the star at the end of the Big Dipper's handle. From that κ (kappa) star of Boötes, shown on the *S&T* chart, drift northwest to find the spiral galaxy M101 in a group of galaxies just over the constellation border into Ursa Major. Peterson describes M101 as exceptionally beautiful. It can also be found by imagining it at the top of a triangle that has the last two handle stars of the Dipper as its base. Once you find it you won't have to imagine it. ★

Then you can scrape the horizon for the huge globular cluster Omega Centauri, which I once saw from near RMTc's site in Southern California, in the region below Saturn. θ (theta) Cen is identified on the May *S&T* chart, and from there go southwest to the ν (nu) Cen- μ (mu) Cen pair shown on the chart and keep going the same direction and distance farther to find Omega touching, or maybe under, the horizon. Omega Centauri is also in the middle of another chart in that *S&T*, on Page 51.

Much easier to find is well-placed Saturn east of the meridian in the evening and directly below bright Arcturus in Boötes the Herdsman. Arcturus anchors the bottom of the elongated kite shape of Boötes. The next star up on the left

ABOUT THE DAS

Membership in the Denver Astronomical Society is open to anyone wishing to join. The DAS provides trained volunteers who host educational and public outreach events at the **University of Denver's Historic Chamberlin Observatory**, which the DAS helped place on the National Register of Historic



Places. First light at Chamberlin in 1894 was a public night of viewing, a tradition the DAS has helped maintain since its founding in 1952.

The DAS is a long-time member in good standing of the **Astronomical League** and the **International Dark Sky Association**. The DAS' mission is to provide its members a forum for increasing and sharing their knowledge of astronomy, to promote astronomical education to the public, and to preserve Historic Cham-

berlin Observatory and its telescope in cooperation with the University of Denver.

The DAS is 501 (c)(3) tax-exempt corporation and has established three tax-deductible funds: the Van Nattan-Hansen Scholarship Fund, the DAS-General Fund and the Edmund G. Kline Dark Site Fund.

More information about DAS activities and membership benefits is available on the DAS website at www.denverastro.org.

AN EXCITING ROMP THROUGH THE STRANGE WORLD OF BLACK HOLES

BOOK REVIEW: GRAVITY'S ENGINES, HOW BUBBLE-BLOWING BLACK HOLES RULE GALAXIES, STARS, AND LIFE IN THE COSMOS

BY CALEB SCHARF, SCIENTIFIC AMERICAN/FARRAR, STRAUSS & GIROUX, 2012

by Darrell Dodge

His highly accessible first book is a fascinating and compelling way to learn about the latest research on black holes, which just about everyone's favorite strange object these days. But it's much more than that. Given his background and occupation as an astrobiologist (at Columbia University), Scharf (PhD, University of Cambridge, 1994), would seem to be an unexpected source for a book on black holes. But that is one of the best things about his book: the author's diverse academic and research background has led him to do some wide-ranging thinking about the implications of the presence and influence of black holes in the universe.

Scharf's premise is that black holes are not only the most important energy source in the cosmos but also the most important element in the creation of the virtually every aspect of the universe we are living in today, including life. There's nary a formula in this book, but that should not deter most people from finding it worthwhile. Scharf's credentials as an astronomer are solid, with extensive experience as a researcher, including work on the Chandra survey of the Fornax galaxy cluster. He also has written a well-regarded textbook, *Extrasolar Planets and Astrobiology*. And he is very good (perhaps too good sometimes) at developing illustrative analogies.

The six chapters of the book concerned with the history, development and characteristics of black holes are framed by an account of the capture of two images of a massive primordial galaxy (4C41.17) about 12 billion light years away. The first, an X-ray image acquired by the Chandra Observatory in 2002, was studied by a team that included Scharf at Columbia University. The second, captured using special filters with the Keck telescopes on Mauna Kea in Hawaii, showed a vast explosion of ultraviolet light from hydrogen gas. When these image were brought together, they helped link the hydrogen bubbles that blow out of the center of the Milky Way and other nearby galaxies (including the

bizarre Centaurus A) to the activity of black holes over the span of 12 billion years.

Scharf's review of the development of the theory of black holes provides information of which many people may be unaware. It was interesting to read about the evolution of conjectures by English geologist John Michell and French mathematician Pierre-Simon Laplace in the late 1700s that there were dark or black stars in the universe, to the eventual understanding that light trying to escape "dark stars" is not slowed down by gravity, but is bent back towards the event horizon, resulting in the generation of huge amounts of radiated energy. Scharf reviews the roles of Karl Schwarzschild, Ralph Fowler, and Chandrasekhar in the understanding of complex massive objects, culminating in American John Wheeler's coining of the term black hole in 1967.

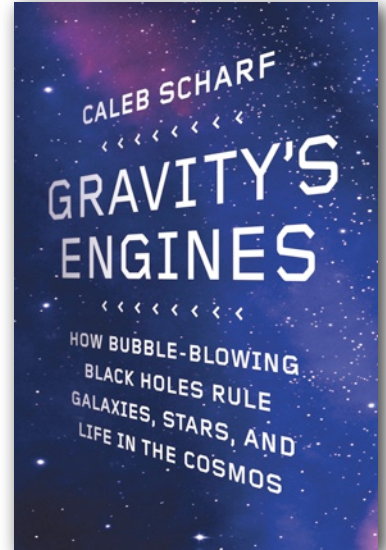
Scharf's love of metaphor and analogy sometimes gets in the way of his narrative. At one point we're asked to imagine "endlessly repeating patterns or structures nested inside one another," at another, "a box with a sack in it that contains a representative sample of the universe." Sometimes these work, however, as when he helps us visualize the energy generated by gravity alone by imagining a potted plant pushed out of a spacecraft, tumbling toward the sun from Earth's orbit. The amount of energy generated by the attraction of gravity alone turns out to be equal to 100 billion apples falling on Earth, or enough energy "to destroy a small town." (My immediate thought was: "but how many flower pots would that be?")

The background on black holes provides the foundation for Scharf's real thesis, set forth in two "Origins" chapters, which concern the relationship of black holes to the creation and evolution of life. "Origins: Part I" tackles the current theories about the order in which various types of stars, quasars, black holes, and galaxies were created and influenced each other. In "Origins: Part II" Scharf con-

cludes—from the emerging galaxy database—that the Milky Way is a rather unique galaxy, with a small, but active black hole that limits the population of stars (providing a relatively quiet green space) while

providing ample radiation and energy to proliferate the molecules required for the creation and nurturing of life.

Scharf's book concludes with a discussion of the telescopic and recording technology required to observe the X-ray photons radiating from the event horizon of the black hole in the core of the Milky Way. The way in which a black hole "feeds" on matter is complex and little understood so far, so that most of our ideas about black holes can only be conjectures—computational or otherwise. As Scharf explains, the development of observational tools to correct this situation has already been started by NASA and numerous research facilities around the world. It sounds far-fetched, but if we are to become a successful civilization and maintain our home planet, we may—as John Bally once said at a DAS banquet—have to figure out how to use the energy generated by black holes. Or maybe even how to protect ourselves from one. ★

**PRESIDENT'S CORNER**

light-years away—it would take them 70,752 years to get there. Where is warp drive when we need it?

Here are a couple more examples of big and small numbers. Electromagnetic signals can be characterized in terms of frequency or wavelength. The 1 MHz radio signal mentioned earlier has a wavelength of ~300 meters (299,792,458 meters). Visible light has a range of wavelengths of approximately 400 to 700 nanometers (nm). The light from those popular green laser pointers has a wavelength of about 532 nm.

Most of us know how big a meter is, but how small is a nanometer? It's 10⁻⁹ meter, or one billionth of a meter. Looked at from a more familiar perspective, the wavelength of green light is about 20 to 30 times smaller than the size of an individual *Giardia intestinalis* protozoan, the nasty tummy bug that's uncom-

fortably familiar to some hikers and campers. Because the frequency of electromagnetic signals such as light is so high, it's more convenient to describe those signals by their wavelength. The frequency of a green laser's light works out to a whopping 563,519,657 MHz.

What does all of this tell us? Our hobby of astronomy is indeed full of really big numbers—for example, distances that light from those dim fuzzies travels to reach our telescopes. Astronomy is full of really small numbers, too, such as the wavelengths of light from those same dim fuzzies. Trying to grasp some of those numbers can be as challenging as trying to figure out how many dollar bills laid end-to-end would fit around the Earth's equator. That number, in case you were wondering, is about 256,948,534. ★

(CONTINUED FROM PAGE 2)

NASA'S Space Place

PARTNERING TO SOLVE SATURN'S MYSTERIES

by Diane K. Fisher

A Space Place Partners' article

From December 2010 through mid-summer 2011, a giant storm raged in Saturn's northern hemisphere. It was clearly visible not only to NASA's Cassini spacecraft orbiting Saturn, but also astronomers here on Earth—even those watching from their back yards. The storm came as a surprise, since it was about 10 years earlier in Saturn's seasonal cycle than expected from observations of similar storms in the past. Saturn's year is about 30 Earth years. Saturn is tilted on its axis (about 27° to Earth's 23°), causing it to have seasons as Earth does.

But even more surprising than the unseasonal storm was the related event that followed.

First, a giant bubble of very warm material broke through the clouds in the region of the now-abated storm, suddenly raising the temperature of Saturn's stratosphere over 150°F. Accompanying this enormous "burp" was a sudden increase in ethylene gas. It took Cassini's Composite Infrared Spectrometer instrument to detect it.

According to Dr. Scott Edgington, Deputy Project Scientist for Cassini, "Ethylene [C₂H₄] is normally present in only very low concentrations in Saturn's atmosphere and has been very difficult to detect. Although it is a transitional product of the thermochemical processes that normally occur in Saturn's atmosphere, the concentrations detected concurrent with the big 'burp' were 100 times what we would expect."

So what was going on?

Chemical reaction rates vary greatly with the energy available for the process. Saturn's seasonal changes are exaggerated due to the effect of the rings acting as venetian blinds, throwing the northern hemisphere into shade during winter. So when the Sun again reaches the northern hemisphere, the photochemical reactions that take place in the atmosphere can speed up quickly. If not for its rings, Saturn's seasons would vary as predictably as Earth's.

But there may be another cycle going on besides the seasonal one. Computer models are based on expected reaction rates for the temperatures and pressures in Saturn's atmosphere, explains Edgington. However, it is very difficult to validate those models here on Earth. Setting up a lab to replicate conditions on Saturn is not easy!

Also contributing to the apparent mystery is the fact that haze on Saturn often obscures the view of storms below. Only once in a while do storms punch through the hazes. Astronomers may have previously missed large storms, thus failing to notice any non-seasonal patterns.

As for atmospheric events that are visible to Earth-bound telescopes, Edgington is particularly grateful for non-professional astronomers. While these astronomers are free to watch a planet continuously over long periods and record their finding in photographs, Cassini and its several science instruments must be shared with other scientists. Observation time on Cassini is planned more than six months in advance, making it difficult to immediately train it on the unexpected. That's where the volunteer astronomers come in, keeping a continuous watch on the changes taking place on Saturn.

Edgington says, "Astronomy is one of those fields of study where amateurs can contribute as much as professionals."

Go to <http://saturn.jpl.nasa.gov/> to read about the latest Cassini discoveries. For kids, The "Space Place" has lots of ways to explore Saturn at <http://spaceplace.nasa.gov/search/cassini/>.

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

SATURN:

This false-colored Cassini image of Saturn was taken in near-infrared light on January 12, 2011. Red and orange show clouds deep in the atmosphere. Yellow and green are intermediate clouds. White and blue are high clouds and haze. The rings appear as a thin, blue horizontal line.

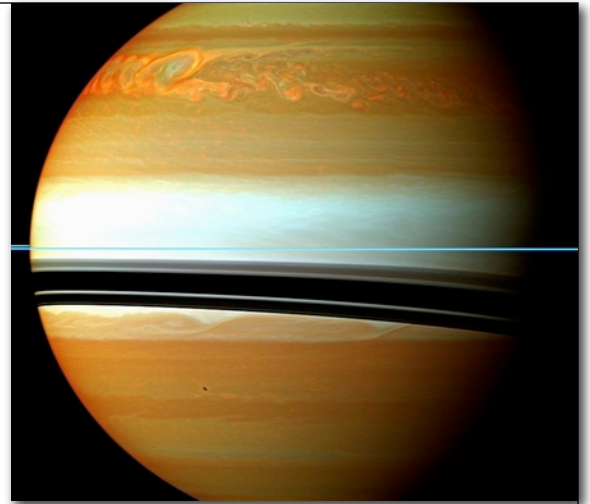


Image courtesy: NASA/JPL

MAY MEETING SPEAKER: TOM FIELD



**YOU CAN
ALMOST
TOUCH
THE STARS**

Even if you wanted to touch a star, they're impossibly distant. But despite these great distances, researchers have learned a great deal about quite a few

stars. How? The most common method to study the stars is called spectroscopy, which is the art and science of analyzing the colorful rainbow spectrum produced by a prism-like device.

Until recently, spectroscopy was too expensive and too complicated for all but a handful of amateurs. Today, though, new tools make spectroscopy accessible to almost all of us. You no longer need a PhD, dark skies, long exposures, enormous aperture. . . or a big budget! With your current telescope and FITS camera (or a simple web cam or even a DSLR without a telescope) you can now easily study the stars yourself. Wouldn't you like to detect the atmosphere on Neptune or the red shift of a quasar right from your own backyard?!

This talk, with lots of interesting examples, will show you what it's all about and help you understand how spectroscopy is used in research. And, it will show you how to get started.

Speaker Bio: Tom Field of Field Tested Systems is a Contributing Editor at *Sky & Telescope*.

Tom's first article in the magazine appeared in August 2011 on the topic of spectroscopy. He's the author of the RSpec software (www.rspec-astro.com) which received their "Hot Product 2012" award last year. Tom is a popular speaker who has spoken at many different venues, including NEAF, the NEAF Imaging Conference, PATS, the Winter Star Party, the Advanced Imaging Conference, SCAE, and others. His enthusiastic style is lively and engaging. He promises to open the door for you to this fascinating field! His talk to the DAS will come to us via webinar, as he'll be speaking from Washington state. Members that can't make the meeting can watch from home via a link at: <http://rspec.webex.com> (although he warns that only seven people can attend in this manner). For questions, email Tom at info@rspec-astro.com. ★

2012 NASA NIGHT SKY NETWORK AWARDS

by Chuck Habenicht, DAS - NSN Coordinator

At this year's Annual Banquet, 48 members of the Denver Astronomical Society will receive awards from NASA's Night Sky Network for their public outreach efforts in astronomy. DAS members reach more than 6,000 individuals during their public outreach events each year.

NASA Night Sky Network Awards will be presented to:

John Anderson	Scott Leach
Judy Anderson	Richard Loper
Evan Anderson	Dena McClung
Eileen Barela	Bill Ormsby (Dearly loved and immensely missed)
Johnny O. Barela	Ron Pearson
Dr. Chuck Carlson	Neil Pearson
Dennis Cochran	Tim Pimentel
Ted Cox	Rod Pinkney
Hugh Davidson	Sarah Rock
Darrell Dodge	Norm Rosling (We miss him and wish him well)
John Doran	Ed Scholes
Doug Dreher	Carl Schulz
Jack Eastman	Jerry Self
Glenn Frank	David Shouldice
Joe Gafford	Clifford Simpson
Ivan Geisler	Paul Thayer
Brad Gilman	Karen Tobo
Wayne Green	Thomas Todd
Chuck Habenicht	Dave Tondreau
George Hammond	Burt Watson
Theron Hampton	Darwin Weber
Cathie Havens	Greg Wimpey
Ron Hranac	Dan Wray
Stuart Hutchins	
Lisa Judd	

DAS Annual Spring Banquet and Installation of Officers

at the

Columbine Unitarian Universalist Church (CUUC)
6724 South Webster Street in Littleton

Get directions at:

<http://www.columbineuuchurch.org/directions.html>
(RE-SCHEDULED (DUE TO SNOW STORM))

May 4, 2013 at 6:00 P.M.

Catered Mexican Dinner

Cost: \$20 per person; members and significant others only

Seating is limited to 70, so get your reservations in ASAP (if you don't already have them). The reservation form may be found at: www.denverastro.org/banquet.html. There is information regarding the Spring Banquet, and includes a PayPal button to make reservations, as well as an email address to use in asking for refunds--All previous reservations will be honored. Due to space considerations, **we cannot accept walk-ins—you must have a reservation.**

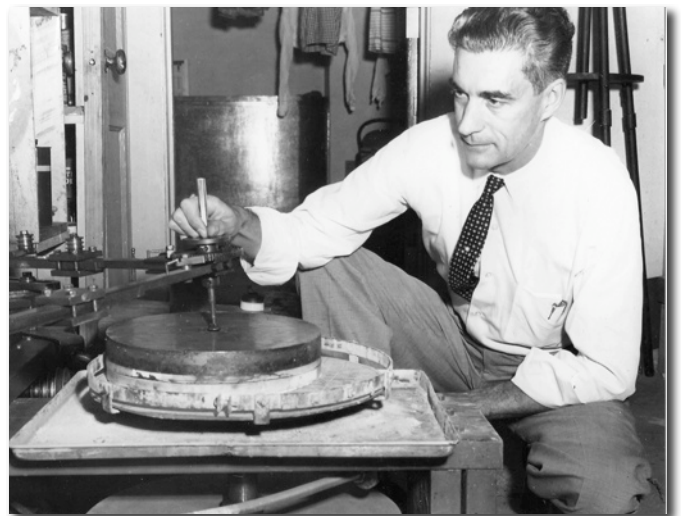
Speaker: William Bottke

Director, Dept. of Space Studies,
Director, NASA/NLSI Center for
Lunar Origin and Evolution (CLOE),
Southwest Research Institute

Talk: Planet Formation: What's New with the Oldest Events in the Solar System?



Fran Ohmer (right, courtesy Mrs. Marian Ohmer) is shown working on the 16-inch mirror on his homebuilt mirror grinding machine in 1960. The mirror grinding machine was donated to the DAS a number of years ago and is now in Chamberlin Observatory's basement. Fran joined the DAS in 1956 and was nationally known as head of the Moon Watch Program in Denver. One of the first "Citizen Science" programs of the early Space Age, members observed and measured the orbits of the early Russian and U.S. satellites. He was a Public Night telescope operator at Chamberlin Observatory for many years. Fran used roll his 16-inch telescope out on his driveway to show kids and neighbors the night sky from his home in Aurora. The telescope was donated to the DAS and picked up from the Ohmer's garage (left photo by Ron Pearson). Left to right in the photo: Ron Hranac, Mrs. Marian Ohmer, Dan Wray and Neil Pearson with Fran Ohmer's telescope.



BEGINNERS BITS—TRANSPARENCY AND SEEING

by Lisa Judd

When someone asks “how’s the sky?” astronomers rarely answer with one word, unless that word is “cloudy.” Indeed, there are plenty of details about cloud cover, air steadiness, humidity, skyglow (including light pollution), and even temperature or ground moisture that one must take into account when describing to other astronomers whether it’s worth going out to a dark site, and even then the conditions can change among very small areas. If you’re working on one of the Astronomical League’s observing lists, there’s a requirement to describe sky conditions as you write down what you’re seeing.

Fortunately, there’s a way to simplify these details when giving an observing report. Astronomers care about two factors: transparency, which is a measure of the sky’s opacity due to clouds or moisture; and seeing, which is basically the twinkle factor of stars caused by the steadiness of the air. You won’t see these factors reported on the 6:00 news’ weather segments, but you can usually bet that both of these variables will be very favorable if you have a high pressure system over your observing site.

Transparency refers to cloud cover of any kind. If the clouds are puffy and well concentrated but there aren’t too many of them, then one can often view objects between them. But, if it’s high cirrus evenly spread throughout the sky, that will limit your observing to bright objects and double stars. High cirrus is also difficult to determine at night. Considering sky moisture, it’s important that humid conditions will spread any kind of moonlight or light pollution much more disastrously than in a dry sky.

If you’re planning an observing session based on what the sky looks like in late afternoon, transparency can be gauged in daylight. A truly great sky

will be a deep, robin’s-egg blue towards the zenith, or if there are puffy clouds it’ll be a deep dark blue between them. The sky will always be a much lighter blue towards the horizons on a sunny day (since you’re looking through a lot more atmosphere), but the lower the deep blue goes the better the sky. In more humid regions, the sky may be sunny but possibly more generally white than blue.

Seeing can be measured with certain devices (similar to light pollution meters but not the same thing), but for logging purposes you can just eyeball it. When there are high winds in the upper atmosphere, stars will twinkle light mad—great for lovers but not astronomers. Not only does bad seeing interfere with the ability to split double stars, but a normally steady galaxy will only look like fleeting glimpses. Interestingly, seeing is rarely affected by winds at ground level, though the wind you feel might shake the scope around a bit—not necessarily a bad thing if you’re hunting dim objects.

As with transparency, seeing is always much worse toward the horizon. The general rule that planets don’t twinkle and stars do can become blurry in this area, as stars will be in and out of visibility whereas bright planets will seem to slowly glow in a blobbing-around sort of way. Seeing can’t be determined in the daytime, as one needs stars first to see how well they twinkle. So if you are planning to observe based on the evening news’ weather report and there’s high pressure, be sure to note whether there’s a jet stream passing overhead as well.

As with anything I contribute, addenda, questions, comments and corrections are welcome. My email address is lm_judd@hotmail.com. ★

LETTER TO THE EDITOR

The PanSTARRS pictures are beautiful, but an ugly reality.

Comets and meteors are more numerous, dangerous, and frequent than documented. The Russian meteor was bigger than first estimated. (1)

Dr. Peter Brown was using Tagliaferri’s data, and initial videos to estimate the first size. It could have been worse than it was. If the meteor over Russia had been going nearer to the vertical there would have been hundreds or thousands dead not just the injured. If this explosion had happened at the altitude of the Japanese bombs the result would have been far worse. There is a well documented effect called the Mach Stem where the incident shock and reflected shock reinforce. The NOVA show *Meteor Strike* simulation last night (2) clearly shows the Mach Stem effect. (The show can be watched online at: <http://www.pbs.org/wgbh/nova/earth/meteor-strike.html>) The ET et. al. estimate is that there is a Japanese bomb sized blast on average YEARLY. There is a .6 Megaton blast on average every 25 years, somewhere. This was not a once in a hundred year event as stated on TV. (3) Tagliaferri (4) Rawcliffe

Because of observational effects on the comet data they are probably many more unseen long period comets than we have seen/documented.

See (5), (6), (7) and (8) by our own previous Chamberlin director Edger Everhart (Posted on the DAS

website at: www.denverastro.org/dfiles/everhart/comet.html). There are similar undocumented observational effects in the meteor data, and I have requested that my previous co-worker Ed Tagliaferri update his article. What would have been the result if such a .6 Megaton blast had happened over Korea or Iran?

P. S. With the NASA education budget cuts we, FRASC, need to do more in the area of cooperation and education. This is an area the Congress and public have not been properly informed. NASA says to pray?

— Franklin Miller, PhD., member DAS, CSAS, SCAS

(1) Update on Russia’s Mega-Meteor
<http://www.skyandtelescope.com/news/Update-on-the-Russian-Mega-Meteor-19553631.html>

(2) Russian meteor, a ‘death rock from space,’ stars on Nova <http://www.latimes.com/news/science/sciencenow/la-sci-sn-russian-meteor-chelyabinsk-nova-20130327,0,853927.story>

(3) *Detection of Meteoroid Impacts by Optical Sensors in Earth Orbit*, Tagliaferri, E.; Spalding, R.; Jacobs, C.; Worden, S. P.; Erlich, A.,

Hazards Due to Comets and Asteroids, Tom Gehrels ed, The University of Arizona Press, Tucson & London



METEOR STRIKE (click link to view video) aired March 27, 2013 on PBS.

(4) *Satellite Observations of Meteors*, R.D. Rawcliffe, *The Astrophysical Journal*, 228:338, 1979 February

(5) *Close Encounters of Comets and Planets*, Edgar Everhart, *The Astronomical Journal*, 1969, June—No. 1370

(6) *Comet Discoveries and Observational Selection*, Edgar Everhart, *The Astronomical Journal*, 1967, August—No. 1351

(7) *Intrinsic Distributions of Cometary Perihelia and Magnitudes*, Edgar Everhart, *The Astronomical Journal*, 1967 October—No. 1353

(8) *Change in Total Energy of Comets Passing through the Solar System*, Edgar Everhart, *The Astronomical Journal*, 1968, December—No. 1365 ★

Note from your Editor:

Hello all! For the past numerous months, we've had a few challenges getting the newsletter out by the 1st of each month. I believe the issues have been solved! As always, I *welcome* your contributions for publication—either timely news stories, feature articles or book reviews, etc. and of course, your photos! This is one of the places you can strut your stuff!

The deadline for newsletter COPY (meaning the printed WORD, not photos) will be the second Friday of each month prior to publication. For the **June issue**, that would be **May 10, 2013**. You're welcome to submit at any time; just be aware that due to publication deadlines, your article might be published later rather than sooner.

If you're unsure that your article would be appropriate, send me the idea (also referred to as "a pitch") in an email to p_kurtz@comcast.net. All copy and photos should be sent to that email address as well. As always, I love the contributors and acknowledge and honor the hard work that goes into anything that makes it to print in this newsletter. Thank you—Patti Kurtz, *Observer* Editor.

WELCOME NEW DAS MEMBERS!

Melinda Beaumont
Benjamin Booker
Jeff Dauby
Robin Francis
David Gillenwater
Chris Huston

Mark Huun
Carol Johnson
Kamil Keski
Bryan LaFonte
David Littleton
Kyle Williams



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