

GuideStar



July, 2013

Volume 31, #7

At the July 5 Meeting

Mosquitoes—How to Deal With Them

Bob Rogers

Last year, at about this time, Bob told us what we should do to avoid mosquitoes buzzing in our ears while our eye is at the eyepiece. He’s back to tell us about this again. In addition to the summer heat and the short nights, nothing can get in the way of a good observing experience like bugs, mainly mosquitoes.

Bob works for Harris County Mosquito Control, so he deals with questions and problems about managing mosquito population growth and the problems these critters can create for city folks as well as country folks.

Take advantage of his expertise and learn how to enjoy a great night of observing despite the bugs.

The *GuideStar* is the winner of the 2012 Astronomical League Mabel Sterns Newsletter award.



The Houston Astronomical Society is a member of the Astronomical League.

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HAS Web Page:

<http://www.AstronomyHouston.org>

See the *GuideStar's* Monthly Calendar of Events to confirm dates and times of all events for the month, and check the Web Page for any last minute changes.

Schedule of meeting activities:

All meetings are at the University of Houston Science and Research building. See the inside back page for directions to the location.

Novice meeting: 7:00 p.m.

“Gems of the Summer Sky”

See page 14 for more information

General meeting: 8:00 p.m

See last page for directions and more information.

The Houston Astronomical Society

The Houston Astronomical Society is a non-profit corporation organized under section 501 (C) 3 of the Internal Revenue Code. The Society was formed for education and scientific purposes. All contributions and gifts are deductible for federal income tax purposes. General membership meetings are open to the public and attendance is encouraged.

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Dues and Membership Information

Annual Dues:Regular\$36
 Associate.....\$6
 Sustaining\$50
 Student\$12
 Honorary..... N/C

All members have the right to participate in Society functions and to use the Observatory Site. Regular and Student Members receive a subscription to *The Reflector*. *The GuideStar*, the monthly publication of the Houston Astronomical Society is available on the web site. Associate Members, immediate family members of a Regular Member, have all membership rights, but do not receive publications. Sustaining members have the same rights as regular members with the additional dues treated as a donation to the Society. *Sky & Telescope* and *Astronomy* magazines are available to members at a discount.

Membership Application: Send funds to address shown on last page of *GuideStar*. Attention - Treasurer, along with the following information: Name, Address, Phone Number, Special Interests in Astronomy, Do you own a Telescope? (If so, what kind?), and where you first heard of H.A.S.

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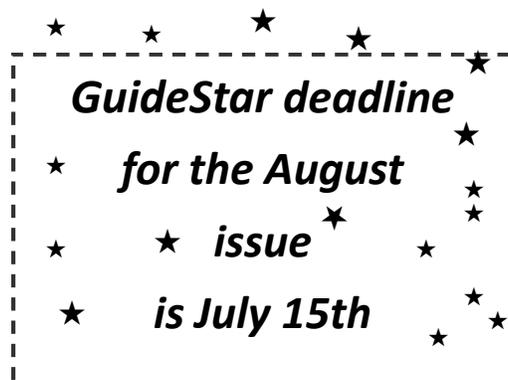
Other Meetings...

Johnson Space Center Astronomical Society meets in the the Lunar and Planetary Institute on the 2nd Friday of each month. Web site: www.jscas.net

Fort Bend Astronomy Club meets the third Friday of the month at 8:00 p.m. at the Houston Community College Southwest Campus in Stafford, Texas
http://www.fbac.org/club_meetings.htm.
 Novice meeting begins at 7:00 p.m., regular meeting begins at 8:00 p.m. Website: <http://www.fbac.org>

North Houston Astronomy Club meets at 7:30 p.m. on the 4th Friday of each month in the Teaching Theatre of the Student Center at Kingwood College.Call 281-312-1650 or E-mailbill.leach@nhmccd.edu. Web site: www.astronomyclub.org

Brazosport Astronomy Club meets the third Tuesday of each month at the Brazosport planetarium at 7:45 p.m. The Brazosport planetarium is located at 400 College Boulevard, Clute, TX, 77531. For more information call 979-265-3376



President's Message

by Bill Pellerin, President

What's Going on with the HAS?

- Inside information — our program team, headed by Bryan Cudnik has lined up some excellent speakers for upcoming meetings. Watch the *GuideStar* in the coming months for these presentations to be announced.
- HAS members continue to do a great job completing Astronomical League observing programs.
 - Lunar Award - No. 818 - Ed Fraini
 - Messier Award - No. 2599 - Steve Fast
 - Outreach Award - No. 490-M - jim Wessel, Outreach, Stellar, and Master
- Rene Gedaly is unable to continue as Secretary for this year, and this means that we need someone to step into this role. If you have a bit of time to support the Society and would like to join the leadership team, please let me know. The Secretary is an executive officer and a board member. The next board meeting is in July.
- Great job on the picnic... !! The picnic happened as planned, with a lot of work from a lot of folks. Thanks for your efforts. I'm told that there were quite a few new members at the site, and that the food was great. Bill Flanagan told me that he saw Saturn through the clouds and a few other objects in Sagittarius. Our observatory committee does a great job. Look for their report in this issue.
- Not HAS news... but. My computer failed last week. Big time. It wouldn't boot and the screen wouldn't light up. The Caps-Lock key would flash, and after some internet searching I found out that this means that the processor has failed. Fortunately, all my data was available from my hard drive (via a USB adapter), but getting a new computer up-and-running is a bit of effort. So, this *GuideStar* is being done on a new (faster!) computer. Most of my astronomy-related software is now installed and working, including the software that I use to produce the *GuideStar*, MS-Publisher 2013. The lesson here is that you should backup your computer on a regular basis. What's important to you is the music, the images, and the documents you've acquired or created over the years. You'll want to be able to get this stuff back!

Parking — Read this...

We can continue to park in the lot across Cullen from the Science and Research Building. The spaces are marked 'Faculty' but are available to us from 6:30 p.m. to 10 p.m.

I have contacted UH Parking and they have confirmed that these spaces are available to us. See the map showing the available parking spaces on the next-to-last page of this *GuideStar*.

You can pay to park in the parking garage near our usual spot. This costs \$3.00. The visitor parking entrance is the one farthest from Cullen Boulevard.

July 5th Meeting Date Confirmed

I've confirmed the availability of our meeting rooms on July 5, 2013. I hope to see you there. Changing the date was considered but never brought before the membership, so we'll be having our meeting on the 'standard' meeting day, the first Friday.

New Article on Astronomy League Web Site

I expanded on my article on page 5 of this newsletter for the Astronomical League Web Site. Check it out at www.astroleague.org

Astronomy League Meeting Begins July 24

The Astronomical League yearly meeting (ALCON) will begin in Atlanta on July 24. These meetings are a lot of fun with great presentations and field trips. Check it out at the same web site mentioned above.

Cheers,

..Bill Pellerin

President HAS

Observations... of the editor

by Bill Pellerin, GuideStar Editor

Summer... officially

Just after midnight (local time) on June 21, summer began, officially. You would be forgiven if you thought that summer was here prior to that date, with some especially warm and humid days. June 21 was the summer solstice, the day on which the Sun is the highest in the sky and, quibbles aside, the longest day of sunlight in the year.

Does the Sun ever get directly overhead from Houston? No, it doesn't. You're probably aware of two lines on the world map called the 'Tropic of Cancer' and the 'Tropic of Capricorn'. These two lines represent the northernmost and southernmost positions of the Sun at summer solstice and winter solstice.



*Tropic of Cancer line on map,
from Wikimedia Commons*

Our latitude, in Houston, is 29.8 degrees north, so we're north of the Tropic of Cancer, the northernmost position of the Sun, which, this year, is at 23 degrees, 26 minutes. The Sun was about 6 degrees south of the zenith on June 21 as it crossed the meridian, and close to M35 at the foot of Gemini.

The good news, of course, is that the amount of darkness per day increases from now until December 21, so we'll have a bit more dark time every day.

How much more dark time? Well, the velocity at which the Sun moves south in the sky varies over that time, but, on average, we get about 1.6 minutes more of darkness every day between now and December 21. This is based on astronomical twilight, which is when the sky gets as dark as it's going to get (not considering moon phase). On June 21, we got just over 6 hours of darkness and on December 21 we'll get almost 11 hours of darkness. We'll have two and a half hours extra of darkness in the evening and two and a half extra hours of darkness in the morning. I'm not taking into account the changes in clock time associated with daylight saving time.

The US Naval Observatory has a web site that shows hours of darkness or daylight for various cities in the U.S. and around the world. The numbers in their calculations don't match mine because I'm using astronomical twilight time, they're using (essentially) sunset time. (Search for "USNO hours of darkness" and you'll find the web site.)

If you have a world globe in your house it may include a strange figure 8 pattern with some dates on it. Without going into great

detail, this shows the position of the Sun in the sky for the year. Because the orbit of Earth around the Sun is elliptical, not circular the Sun is not always on the meridian at mid-day. This, perhaps, is the subject of a new article.



*The Analemma,
from Wikimedia
Commons*

The line is called the Analemma and it shows the position of the Sun at solar noon for any date of the year.

Until next time...

clear skies and new moons!

..Bill

High Energy Spy

By Dr. Martin C. Weisskopf

The idea for the Chandra X-Ray Observatory was born only one year after Riccardo Giacconi discovered the first celestial X-ray source other than the Sun. In 1962, he used a sounding rocket to place the experiment above the atmosphere for a few minutes. The



Composite image of DEM L50, a so-called superbubble found in the Large Magellanic Cloud. X-ray data from Chandra is pink, while optical data is red, green, and blue. Superbubbles are created by winds from massive stars and the shock waves produced when the stars explode as supernovas.

sounding rocket was necessary because the atmosphere blocks X-rays. If you want to look at X-ray emissions from objects like stars, galaxies, and clusters of galaxies, your instrument must get above the atmosphere.

Giacconi's idea was to launch a large diameter (about 1 meter) telescope to bring X-rays to a focus. He wanted to investigate the hazy glow of X-rays that could be seen

from all directions throughout the sounding rocket flight. He wanted to find out whether this glow was, in fact, made up of many point-like objects. That is, was the glow actually from millions of X-ray sources in the Universe. Except for the brightest sources from nearby neighbors, the rocket instrument could not distinguish objects within the glow.

Giacconi's vision and the promise and importance of X-ray astronomy was borne out by many sounding rocket flights and, later satellite experiments, all of which provided years-, as opposed to minutes-, worth of data.

By 1980, we knew that X-ray sources exist within all classes of astronomical objects. In many cases, this discovery was completely unexpected. For example, that first source turned out to be a very small star in a binary system with a more normal star. The vast amount of energy needed to produce the X-rays was provided by gravity, which, because of the small star's mass (about equal to the Sun's) and compactness (about 10 km in diameter) would accelerate particles transferred from the normal star to X-ray emitting en-

ergies. In 1962, who knew such compact stars (in this case a neutron star) even existed, much less this energy transfer mechanism?

X-ray astronomy grew in importance to the fields of astronomy and astrophysics. The National Academy of Sciences, as part of its "Decadal Survey" released in 1981, recommended as its number one priority for large missions an X-ray observatory along the lines that Giacconi outlined in 1963. This observatory was eventually realized as the Chandra X-Ray Observatory, which launched in 1999.

The Chandra Project is built around a high-resolution X-ray telescope capable of sharply focusing X-rays onto two different X-ray-sensitive cameras. The focusing ability is of the caliber such that one could resolve an X-ray emitting dime at a distance of about 5 kilometers!

The building of this major scientific observatory has many stories.

Learn more about Chandra at www.science.nasa.gov/missions/chandra. Take kids on a "Trip to the Land of the Magic Windows" and see the universe in X-rays and other invisible wavelengths of light at spaceplace.nasa.gov/magic-windows.

Dr. Weisskopf is project scientist for NASA's Chandra X-ray Observatory. This article was provided by the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.

NASA Space Place

Catch a Fallen Star

by Don Selle

If you have done much observing under dark skies, there is no doubt that you've witnessed the flash of a meteor entering Earth's atmosphere. If you are observing with a group of other astronomers, and especially at larger star parties, it's very common to hear someone call attention to a "shooting star". It really doesn't matter what time or date, if you are out under the night sky there is a very good chance that you will see a meteor.



*Meteor Shower of 1833 at
Niagara Falls*

Meteor showers are one of the annual astronomical events that interest both amateur astronomers and the public. They occur at known times and these events are opportunities for active visual observing. We tend to focus our attention on observing known meteor showers because the dates and sometimes the intensity of the shower can be predicted. That makes it easy to plan ahead to observe them.

Known meteor showers are named after constellations. The Perseids meteor shower in August (Aug 11 & 12) for example is named for the constellation Perseus which contains the point in the sky, called the radiant where the shower of meteors seems to originate.

This year's Perseids coincides with a first quarter moon. The radiant will rise above the horizon at about the time that the moon is setting. When the weather is good, and the moon phase is favorable, it can be a very enjoyable experience to sit back in a lounge chair facing the radiant, and keeping count of the number of meteors observed per hour.

The predictions of meteor showers are possible since the majority of the meteors come from the debris left behind an orbiting comet. Comets are closely tracked and their orbits are generally determined quite accurately. The dust and ice particles shed by the comet as it is heated by the Sun's radiation continue to orbit the Sun. Most of these meteors are small. They range in size from sand grain size to maybe the size of small pebbles.

When they finally come close enough to become trapped by Earth's gravity, they enter our atmosphere with a high speed. The resulting heat due to air friction causes them to heat to incandescence and we see them as streaks of light in the dark night sky. A good meteor shower will have a high meteor count per hour with many bright ones.

There have been several meteor showers in history that have been spectacular.

The brighter meteors, whether they are part of a meteor shower or individuals, are sometimes called bolides. Bolides can be pretty spectacular to witness themselves. The light from them can be very bright, sometimes rivaling the brightest objects in the night sky. The bigger they are – the more awesome and memorable the experience of seeing one can be.

Several years ago at TSP, under the dark skies of the Davis Mountains, I witnessed such a bolide along with the rest of the star party. It was well into the early morning hours when the sky lit up so brightly that, to my eyes, it was easy to see details across the observing field. The light cast dark shadows on the ground which rotated as the meteor flashed past us.

The flash lasted on the order of 10 seconds as the large meteor streaked across about 90 degrees of the sky. It left a dimly glowing trail behind it which faded quickly from view, and I'm sure that, as improbable as it seems, while it streaked past, I heard a distinctive sizzling sound. The bolide finally disappeared over the mountains to the north of us.

There was a great rush of excitement on the field as we all wanted to express our awe at the sight of such a magnificent display. And there was a great deal of speculation as to whether the meteor actually completed its fall to earth and became a meteorite, or if it disintegrated while still in the air.

Bolides and large meteor falls have been known since antiquity though their true nature was either not known or in some cases concealed as it conflicted with prevailing superstitions or strongly held beliefs about the nature of the sky. It was not until 1803 that a report of a meteor fall was investigat-

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ed by scientific and governmental authorities and finally accepted for what it was.

In this case on April 26 of that year, at approximately 1:00 pm in the sky over the country side about 60 miles west of Paris, a flash of light was seen and an explosion occurred. The sound of the explosion was said to sound like carriage wheels over cobblestones and to last from 5 to 6 minutes. It was so loud and disturbing that teams of horses bolted in terror and peasants in the fields were frightened half to death. The noise of the explosion was followed in some localities by a rain of stones falling from the sky, many coming close to hitting people on the ground. In all it is estimated that approximately 3000 individual pieces were recovered, which is probably only a fraction of the fall.

Jean Baptiste Biot a physicist, astronomer and mathematician who discovered that light can be polarized, was dispatched to the scene to investigate. He was convinced that the stories that had reached Paris of stones falling from the sky was true since the large number of varied individuals who bore witness to the event, were all telling virtually the same story.

“This agreement, already verified in a great number of observations, gives to this probability a value which is very close to a certitude and which is by no means infirmed by the objection that the witnesses are but little educated; for, precisely because of the paucity of their education their testimonies should, if the facts were false, evoke diverse substances, dissimilar circumstances; and for a topic of this nature, in which particular personal interest enters for nothing, the chance of the convergence of testimonies is unique, whereas that of their divergence is infinitely multiple¹.”



Jean Baptiste Biot

In addition to their testimony, many of the witnesses to the fall had collected the stones that had fallen. The fact that the stones provided as evidence were all very similar to each other was not lost on Biot, who also carried with him a stone from a fall reported years earlier, which was also similar to those found in L'Aigle. The evidence for Biot was overwhelming.

(As an interesting side note, I have found pieces of one of these historic stones for sale. Caution – a growing interest in meteorites can be hazardous to your astronomy budget!)

It would take several years before acceptance that meteorites are a natural phenomenon became common throughout Europe and the United States. Collecting meteorites for display in museums progressed throughout the remainder of the 19th and into the early 20th centuries.

Meteor falls were treated as rare events, oddities worth noting but of little practical value either commercially or scientifically. Beyond classifying them, there was no coordinated effort made to truly understand them. The science of meteoritics had yet to come into being.

On the evening of Nov. 9 1923, a meteor streaked across central Kansas. Harvey Nininger, a biology teacher at McPherson College in McPherson, Kansas, witnessed the flash of light and took careful note of its direction. He was certain that as a result of the flash, somewhere in southeastern Kansas a meteor fall occurred as a result. Having previously read several articles about meteorites, Nininger was already intrigued by them. He vowed on the spot to track down and recover this meteorite.

Thus began the career of one of the world's greatest meteorite hunters and investigators. Nininger was convinced from the start that meteorites were important and precious, being the only material from the vast reaches of space that we can touch and study, the only key we might have to physically understand what our solar system is made of.

“I spent many hours pondering the phenomena of meteorite falls and their uniqueness. It seemed to me that by any fair appraisal the arrival of a meteorite from space must be one of the most basic and fundamental of natural events. Here was a source of information concerning the universe beyond our atmosphere of a kind that astronomers were making no special effort to utilize. Here was a more or less contribution to our planet from outside space which geologists seemed to be making no effort to evaluate except as accidental recoveries were thrown into their laps².”

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Nininger started his search for the Nov. 9th fall by collecting reports of the sighting of the bolide from all over the state. He asked newspaper editors to run notices requesting information and he spoke with police officers, ranchers and average people trying to correlate what they saw to a line on a map that would help him define an area where the fall had occurred.

After sifting through a large number of reports, Nininger settled on two locations where the fall might have occurred. One was near the town of Coldwater Kansas the other near Greensburg. In order to try to recover the meteorite, Nininger reasoned that the local farmers would be most likely to find the "odd" rocks. This being so, he began to give talks to the people living nearby. He also had several newspaper stories run describing to people how they might determine if an odd rock they had found might be a candidate meteorite. He also offered to buy confirmed meteors at the price of a dollar a pound.



Dr Nininger in his basement study

In the end, two meteorites were found. Both though showed signs of weathering, rust streaks on their outsides due to the corrosion of the iron in them. Though he was successful in recovering two previously unknown meteorites, the meteorite of the November 9th fall would finally elude him.

His success at finding previously undiscovered meteorites encouraged him to make a serious effort to recover more. The technique that he used on his first success was expanded as Nininger explained in his 1972 autobiographical book *Find a Falling Star*:

"I conceived a plan to take the public into my confidence and form a sort of partnership with residents of the area in which I believed the meteorite might have fallen. During late 1923 and into the autumn of 1924, I made several excursions into the vicinity of Coldwater and Greensburg, Kansas, visiting schools, asking cooperation of the press in printing appeals. I explained the nature and behavior of meteorites and the reasons they are valuable for study, then offered to pay a good price for any specimen found. I counted on this incentive to alert the whole community to interest in the meteorite. So far as I know, this method had not been used before.

The plan I followed in 1923 is the one I have used ever since. And, until such time as provision shall be made to secure instru-

mental data by means of automatic devices, I am convinced that this is the only method for successful "chasing" of fireballs³."

A side benefit of his approach to meteorite "hunting" was that in an effort to increase the number of eyes looking for meteorites, he would educate the public, at a time when very little was taught about meteorites in either high schools or universities, even in astronomy or geology courses. As Nininger became more successful at finding new meteorites, he realized that through his efforts to learn all he could about meteorites, he had become an authority on them. His conviction grew that meteorite falls were such a common enough occurrence that over a long stretch of time, meteors should have fallen in most places on earth. In addition, if geologists understood what to look for, meteorite finds would be fairly common, perhaps as common as fossils in rock strata.

Buoyed by this insight and his continued success, including the 1930 recovery of the largest rocky meteorite found to that date, Nininger decided to leave his teaching job in order to pursue collecting and investigating meteorites on a full time basis. Throughout his career, he was supported by his wife Aidee and at various times by his children who helped in his work.

Nininger intended to prove his theory that contrary to popular belief, meteor falls were common on a geologic time scale. By collecting meteors from as many locations around the continent, he hoped to prove this hypothesis. He also hoped to collect a wide variety of meteorites that he could study in detail and describe so that the information gathered could be used to support theories of how meteors are formed and what part they may have played in the formation of our solar system.

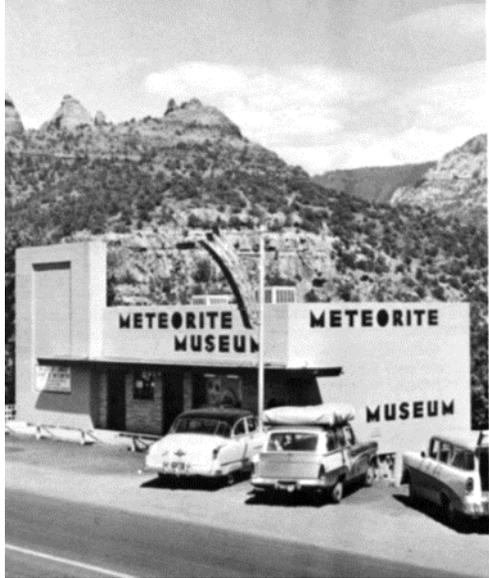
Nininger's plan was to support his family through fees paid for his lectures on meteorites, and by selling samples of the meteorites he found to institutions that would study and exhibit them. In addition he would apply for

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grants to support his scientific work, however these were few and far between, during the Great Depression, and meteoritics was not viewed as a serious branch of science.

Over the course of his career, on a self-supported basis, Nininger became the world's foremost expert on meteors and meteor falls. At one point it was judged by other scientists with an interest in meteorites



Nininger Meteorite Museum Sedona AZ

that Nininger was responsible for more than half of the meteorites recovered worldwide.

As part of his outreach program, as well as to raise money for his collecting and specimen preparation operations, Nininger opened a Meteorite Museum on Route 66 within sight of Arizona's meteor crater which he planned to investigate.

Over the years since it was discovered, the crater had been viewed as volcanic in origin,

though many who examined it believed otherwise. It was purchased by the Barringer family who had mining interests. If the crater was excavated by a meteorite the Barringers believed, recovery of it might have high economic value.

Calculations by Dr. F. R. Moulton, a noted physicist and member of the American Academy of Sciences had calculated that there would be no meteorite found in the crater. The energy of the collision would be so high that the meteorite would be disintegrated. This theory was not accepted until Nininger collected numerous small pellets of nickel iron which had all of the characteristics of being melted and re-solidified in the air. Nininger also found and documented many effects of the shock of the collision which validated Moulton's calculations.

One of the main motivations for Nininger's work was to educate the public about meteorites, their origin, composition and importance. In all, he published 162 scientific papers and four books on meteorites and meteor falls. He also gave countless talks and lectures at venues ranging from major universities and scientific conferences to high schools, church and civic groups.

Throughout his career, Nininger advocated for a program of meteorite research and education. He was a strong believer that if more minds were brought to bear on meteorites, their composition, origin and

impact on Earth's geology, the more that would be learned that could be applied to astronomy, ballistics and aeronautics. He was however a man ahead of his time. For most of his career, he was almost a lone voice in the wilderness.

Upon his retirement, his extensive collection of meteorites was sold, part to the British Museum of Natural History and the bulk to Arizona State University at Tempe which has a leading program in meteoritics, a program that Harvey Nininger by his example helped to initiate.

Notes:

1. Jean Baptiste Biot – "Relation of a Voyge Made in the Departement of the Orne", in order to verify the reality of a meteorite observed at L'Aigle on the 6th of Floreal of the year 11 [26th April, 1803]
2. Harvey H. Nininger – Find a Falling Star page 12 – Published 1972 by Paul S. Ericson, New York
3. Harvey H. Nininger – Find a Falling Star page 16 – Published 1972 by Paul S. Ericson, New York

Just Looking

A GuideStar Interview by Clayton L. Jeter

Jason Ware—Astrophotographer



If you're ever walking the upper field at the Texas Star Party and you stumble upon the largest, latest and greatest Schmidt Cassegrain telescope with all the bells and whistles, you can better bet that it's Jason Ware's rig. I see him every year on the field tending to his equipment getting ready for sunset to start his night long photo shoots. If you haven't seen Jason's astrophotos, then you're in for a real treat. "Stunning" is the keyword here.



I hope you shutter bugs enjoy this month's read about a longtime Texas astrophotographer. Here's Jason...

The Jason Ware bio...

Ware has been photographing the night sky since 1989 using exclusively Meade Instruments telescopes.

He began astrophotography using black & white and color films hypersensitized in his home built chamber. In 2005 Jason began using CCD cameras.

In 2009, he began using an Apogee Instruments 6303 U9. This instrument now produces images with

lower noise and fewer artifacts.

Jason has been a beta tester for Meade, has over 200 published images and a speaker at various astronomy and photographic venues.

His images can be seen at his website <http://galaxyphoto.com> and [Astrophoto of the Day](#) (enter Jason Ware to search).

The Jason Ware interview...

Clayton: Great to have you here for an interview. Many of us have seen you shooting photos through one of your Meade telescopes. How did you and Meade hook up? How did you first become interested in astronomy in the get-go?

Jason: Thanks Clayton. I have loved astronomy since childhood but never knew how much you can see with an amateur telescope. In 1989 my soon-to-be wife bought me a 60mm refractor. In looking through magazines trying to learn about it I got hooked on the

photos. Shortly thereafter I bought an 8" Meade LX5 and began taking pictures. I got several of them published in *Sky and Telescope* along with sending them to Meade and it got their attention. They had just released their line of semi-apo refractors and asked me if I wanted to be a beta tester. Of course! I have been beta testing for them ever since.

Clayton: We have all read that Meade has had its ups and downs in the last few years. I just read that Meade was recently purchased by a Chinese company. Have you heard any news on what's new? Are there any new products on the horizon?

Jason: Meade has not yet been purchased. There is a proposal for merger but it is not yet final. I don't know anything more than is publicly available.

Clayton: I know you take photos for and through Meade scopes, are there other folks doing the same for Meade? Do you have a mentor?

Jason: There are some other beta testers, Jack Newton for example, but they don't push the limits as much as I do. I am using a high-end Apogee U9 6303 camera with higher resolution than a DSLR so it really tests the equipment. Meade has made steady improvements over the years, I am working with a 14" LX850 and it's the best system they have produced to date.

Clayton: Do you pursue visual astronomy at all?

(Continued on page 12)

Jason: Some, I used to do a lot more, I have my Messier and Herschel I observing certificate. Now I just like to sit back and enjoy the night sky while capturing image data.

Clayton: At TSP-2012 I saw your giant Meade telescope on the upper field. Tell us about that scope and its design and how you assembled this monster.

Jason: You are probably talking about the 20" Max. I can actually set this up at home by using an engine hoist. I jack up the legs and put rollers under them, and then roll it in and out of the garage. At TSP I have to get help from three or four people. I am not able to use it right now. Meade is upgrading the drive to the same system as the 14" so it's back at the factory, however, the 14" is almost as good!

Clayton: Do you shoot at the Dallas clubs observatory site? Tell us all a little about this site.

Jason: Yes, I have a 12x12 ft roll-off at the Atoka site. It houses a 12" Meade Schmidt Camera, one of only two in existence. But it doesn't get much use these days, film is limited and I don't find the time to get up there as much as I would like to. I need to convert it to CCD (like David Levy did) but there are steep technical and cost issues in doing so.

Clayton: What's your attraction to the night skies? Got a favorite object that you like to shoot?

Jason: I am a child of the space race so I guess I have always liked space and the stars. I am an avid Star Trek fan. I get it from my mom. We used to lay out in the back yard and stargaze when I was a young boy. No real favorite objects. I do like to shoot dark nebulae, I think they are under appreciated.

Clayton: How would you like to see your own astronomy grow?

Jason: I have been doing long focal length imaging for a while now. I would like to get back to some wide field imaging like I did with the Schmidt Camera. Maybe a wide field refractor. That would work better at TSP anyway, the seeing rarely supports high power.

Clayton: I'd like to know about your cameras and photo program that you use to create your stunning astrophotos.

Jason: As I said I mostly use an Apogee 6303 U9. I do most of my work from the city using Astro Don narrow band filters. I capture, calibrate and combine the images with Maxim DL then finish up in Photoshop.

Clayton: It seems in recent years that the younger people are not that interested in amateur astronomy, let alone taking photos (\$\$\$\$). Have you ever considered teaching astrophotography as a form of outreach?

Jason: It's not just astronomy, its science, and other hobbies like RC flying and rocketry. I think we have failed as a society to foster math and science. Our heroes are sports and movie stars. Now, I am a huge hockey fan and I love movies but there has to be a balance. I wish our political leaders would praise those who excel in math and science. The space program reductions are really sad.

I used to do a lot of outreach but got busy raising kids. I was a speaker at the TSP Imaging Symposium this year. Maybe in retirement I can do more but that is still a few years away.

Clayton: Do you have any helpful advice to pass on to observers just starting out in astrophotography?

Jason: Just do it! Do as much as you can from the city. It amazes me how many people come to the TSP expecting to take great photos when they have not taken the camera out since the year before. Practice under a city sky then excel under a dark sky.

Clayton: Is there an email address that you have that a Houston Astronomical Society member could contact you for an additional question or two?

Jason: The best way is to visit my website galaxyphoto.com. Anyone can contact me from there.

Clayton: Thanks Jason for taking the time to share your interest and thoughts within our HAS newsletter, the *GuideStar*. We wish you luck with all of your astronomy interests. Please come visit our society when in the Houston area, we'd love to see you.

Clear skies always,

Jason: Thanks, and good luck with your club. Hope to see everyone at a star party soon!

Clayton is an avid SCT visual observer and a longtime member of the Houston Astronomical Society. Contact him at: stonebloke@gmail.com

Observatory Corner

By Bob Rogers, Observatory Chairman

Hello everyone.

Well, summer has arrived along with the heat, humidity and Mosquitoes. Make sure to drink plenty of water, take breaks in the A/C and protect yourself with Mosquito spray. As I write this article, Harris County just got its first Mosquito positive for West Nile virus in the Atascocita area.



HAS member Marty Levine brought out his Boy Scout troop to the site on the May 18th weekend. Due to Truck problems, I wasn't able to make it, so Allen Wilkerson covered for me. Here is his report - The boy scouts had a good time yesterday having one of the "first" primitive camping experiences.

Do not worry; I did not let them dig latrines. I filled out a log report with the troop number and names of all the scouts on it. They were treated to solar observations and very basic star observations. There was too much haze from Mexico to really see anything clear though there were more than a few "sucker holes" to allow partial views of Saturn and the moon. They did clear all the underbrush and dead limbs from the picnic area to the burn pile as a service job. I gave several tours of the Observatory and some basic astronomy facts as way of compensating for the overcast skies. Marty was very impressed with the condition and changes made at the site over the past year. Thanks to Marty and his group for all their work.

The June HAS Picnic Star Party was held on June 8th at the HAS Ob-



serving site. I want to thank Steve Fast for a wonderful job for putting this all together. Thanks also goes to Mike Edstrom for a great job on the grills cooking all that chicken, it sure tasted good. Also, thanks goes to Allen Wilkerson for coming out a couple of days before to do mowing and weed trimming to make the place look good. It looked like the weather was going to cooperate until sunset and then it clouded up. We were able to get a few looks at the Saturn Nebula through the clouds. In all, it was a great time and fun to see a lot of new faces out there. Welcome new members.

And finally, the most important news - The Houston Astronomical



Society Home Owners Association

has awarded the "Yard of the Month"



to Don and Anna Taylor for all their great work around their RV. Congratulations, you have set the bar for everyone else.

If you are interested in making a donation to the Observatory, please do so when making you dues payment and let either Steve



Fast or Don Selle know that you are donating to the Observatory so the donation goes to the right place.

And the work goes on

I do need to remind everyone that we need

to start filling out Log Reports at the site so I can give this information to the Fondren Foundation. The property is on a 99 year lease and part of the Lease agreement is that HAS needs to report every year to the Fondren Foundation that the Property is being used. The Log Reports are located in the box in the middle of the field. Just open the cover, fill out the report and then slide it

(Continued on page 14)

Novice Presentation July, 2013

Gems of the Summer Sky

By Debbie Moran

The July Novice topic will be Gems of the Summer Sky. This will be a basic sky identification presentation covering summer constellations and many of the glorious objects that can be seen among them.

In August Scott Mitchell will give one of his delightful sketching classes, this time on the planets. Even if you do not plan to sketch, the knowledge on how to train your eye to see details will be invaluable.

Summer Reading

By Bill Pellerin, Editor

The newspapers and magazines are filled with articles on summer reading. I suppose the idea is that we're to lie in a hammock on or near the beach, book in hand, and catch up on the reading we missed in the winter. Anyway, there are some titles in the world of astronomy that you may wish to consider:

The Day Without Yesterday, by John Farrell. The story of the discovery of the expanding universe. Recommended by Don Selle

A More Perfect Heaven, by Dava Sobel. (author of *Longitude*) How Copernicus revolutionized the cosmos

The Signal and the Noise, by Nate Silver. A book about how extract useful information from the surrounding noise (perfect for astro-imagers)

Our Final Hour, by Martin Rees (author of *Just Six Numbers*). Subtitled: A Scientist's Warning: How terror, error, and environmental disaster threaten humankind's future in this century—on earth and beyond

The Sun's Heartbeat, Bob Berman (editor for *Astronomy* magazine). A series of chapters describing various aspects of the Sun and what we know about it.

Seeing Further, by Bill Bryson. Subtitled: The Story of Science, Discovery, & the genius of the Royal Society.

The Day We Found the Universe, by Marcia Bartusiak. The scientific history leading up to the discovery by Edwin Hubble that the Andromeda Galaxy was outside the Milky Way... way outside.

Empire of the Stars, by Arthur I. Miller, Subtitled: Obsession, friendship, and betrayal in the quest for black holes. I found this one at used book store for a good price. It's about Subrahmanyan Chandrasekhar and his relationship with Sir Arthur Eddington

(Continued from page 13)

into the slot that is in the inside of the cover and then close the box. It is very important that everyone fill out a Log Report so that we are showing that the Observing site is being used. Your help on this is very much appreciated.

If you have a Randalls card, and have not done so, please have it coded for the Houston Astronomical Society. Our number is #6618. The Society gets 1% of the gross sales that members spend at Randalls. Randalls totals up the amount spent each quarter and will send us a check if the amount goes over \$2,500.00, otherwise the total roles over to the next quarter or zeros out at the end of the calendar year. So please link your Randalls card to the Houston Astronomical Society so that the society can benefit from this Randalls program. Our number is #6618. This is very easy to do, just go to the Courtesy Booth and tell the person there what you want to do.

If you have any suggestions or thoughts for the site, let me know.

Thanks,

Bob Rogers

Observatory Chairman
281-460-1573
siteworkerbob@hotmail.com

Trailer/RV spots available free for weekend use at the site. Contact the Observatory Chairman, Bob Rogers siteworkerbob@hotmail.com for more information

Clarity Sought on a Crucial Variable Star

Monica Young, www.skyandtelescope.com

SS Cygni, one of the most-watched variable stars, lies at a distance that's hotly disputed. The truth will determine whether we understand how these types of variables work.

One of the most popular variable stars for amateur observers and professional researchers alike is SS Cygni, now climbing the eastern sky each evening. Not one outburst has been missed since its discovery in 1896, thanks to the vigilance of thousands of backyard observers in the American Association of Variable Star Observers (AAVSO). They've watched this dwarf nova flare from magnitude 12 to 8 for a few days every month or two for over a century. Testimony to their dedication is the century's worth of SS Cygni brightness measurements that encircle AAVSO's main meeting room. The poster stretches more than 100 feet long.

Yet despite the more than 500,000 observations made over the years, SS Cygni has been at the center of a puzzle that threatened everything we thought we knew about dwarf novae. Now some astronomers think they've solved the mystery. Others say they're jumping the gun.

SS Cygni consists of two stars tightly whirling around each other every 6½ hours in a cosmic pas de deux. One is a red dwarf, a normal star smaller and cooler than the Sun. The other is a white dwarf: a tiny, hot, super dense stellar corpse. The matter falling from the companion to the white dwarf piles up in an accretion disk. Eventually the disk becomes overloaded and suddenly dumps the whole load onto the white dwarf. The load releases its gravitational energy in a big flare when it lands.

That's the theory. Contradictory observations over the past 15 years have had astronomers puzzled by what makes SS Cygni tick. Recently James Miller-Jones (Curtin University) and his colleagues released a new radio study in the journal *Science* that may resolve, or just fuel, the ongoing debate.

Too Big and Bright?

Before 1999, astronomers thought they had SS Cygni all figured out. In particular, they thought they understood the exact gas dynamics happening inside the accretion disk, and why the gas would suddenly change viscosity ("slipperiness") causing the disk to jam up and then collapse. This "disk-instability model" became the theory of choice for dwarf novae in general. And it has wider importance; it serves for a

wide range of close-binary cataclysmic variables, including exotic ones including a neutron star or black hole.

But Hubble Space Telescope (HST) observations posed a major challenge to the prevailing model. Tom Harrison (New Mexico State University) led a team in using Hubble's exquisitely precise Fine Guidance Sensors to measure parallax distances to several nearby dwarf novae.

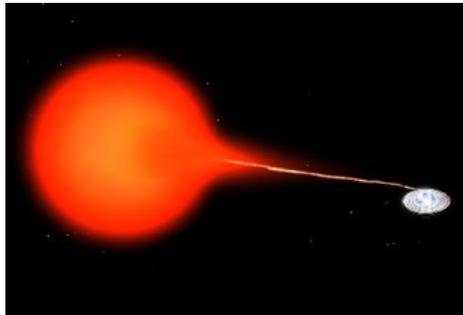
Parallax is the simplest method of measuring a nearby star's distance. It's easy to see how it works — hold your finger in front of your face and close first one eye, then the other. Your finger will appear to move against the background. It'll move less the farther it is from your eyes. By measuring SS Cygni's apparent movement against background stars as Earth orbited from one side of the Sun to the other, Harrison's group found a distance between 500 and 580 light-years for SS Cygni.

The problem was that the greater distance made SS Cygni's stars too bright and its rate of mass transfer too great. The gas dynamics in the accretion disk now came out all wrong.

"At [the Hubble] distance, SS Cygni would have to be so luminous that it should always be in outburst," says Greg Sivakoff (University of Alberta, Canada), an author of the paper. But a century of observations contradicted that conclusion, so "some theorists began to question the [disk-instability] model, while others questioned the HST parallax."

In the latter camp was Miller-Jones. He recently led a team that remeasured SS Cygni's annual parallax shift by means of radio. Unlike optical parallax, which compares SS Cygni's position against background stars in the Milky Way, radio parallax compares against background sources outside our galaxy, so far away they show zero parallax motion.

(Continued on page 16)



In SS Cygni a white dwarf pulls gas from its companion star. The gas falls into a disk, but the rate of infall is too slow to be stable — the disk switches into a hot, bright outburst every five to nine weeks.

Bill Saxton, NRAO / AUI / NSF

(Continued from page 15)

There was just one problem — SS Cygni only becomes radio-bright at the very beginning of an outburst, when the collapsing accretion disk likely fuels a jet that's ejected from near the white dwarf's poles. To catch SS Cygni at this crucial time, the professionals would need the help of the diligent skywatchers in the American Association for Variable Star Observers.

Amateurs Step In

"SS Cygni is always well observed regardless of what's going on simply because it's a very popular star," notes Matthew Templeton of the AAVSO staff. So response was plentiful when the AAVSO put out a bulletin notifying its members that Miller-Jones was looking to catch the first stages of its outbursts. "Really all we were trying to do was encourage people to do what they were already doing," Templeton says, "but to notify us very quickly if they saw SS Cygni going into outburst."

Templeton notes that visual observations — the old-fashioned practice of eyeballing a star's brightness against standard stars in the same eyepiece view — played an important role in monitoring SS Cygni, triggering at least one radio observing run.

For 2½ years, as soon as AAVSO members noticed an outburst, Miller-Jones's team followed up with radio observations using the Very Long Baseline Array (VLBA) and the European VLBI Network. "This project would not have been possible without the AAVSO," says Sivakoff. A total of 280 AAVSO observers participated. The radio team compared SS Cygni's position against a radio quasar billions of light-years in the background — and came up with a distance of 365 to 378 light-years.

That's much closer than the Hubble measurement. It puts SS Cygni back where it belongs, at least according to theory: at a lower luminosity, where the disk instability model predicts that the star should flare and fade the way it's observed to do.

Problem Solved? Not So Fast

If the radio measurements are right, the question remains: why were Hubble's fine-guidance sensors wrong? They've done superb parallax work elsewhere.

Miller-Jones and his colleagues propose a couple of ideas in their paper. The problem could lie with an unlucky inaccurate measurement of one or more of the background stars in the Hubble observations. Or the problem could be a subtle statistical bias, "the kind that bores readers to death but can plague astronomers," Sivakoff says, half-joking.

Both of these explanations require such huge errors that they become unlikely, though not impossible. Harrison isn't buying it.

"We remain confident in our result that the distance to SS Cygni is much greater than the theorists would like it to be," Harrison states, adding that he's preparing a paper in response to Miller-Jones's results.

Moreover, he says there's a problem with Miller-Jones's team picking SS Cygni to observe. After all, they can't observe the other nine dwarf no-

vae that do match the disk-instability model because they're not bright enough radio sources.

"Unless you can identify the specific reason why you believe the result for SS Cygni is wrong, you either have to reject all of the parallaxes or accept all the parallaxes. You do not get to pick and choose which ones you like," Harrison says.

Harrison also notes other potential problems with the study. For example, the radio emission measured by Miller-Jones comes from a jet streaming away from the white dwarf's poles — but the jet could be launched well above the accretion disk, and the jet could also bend over time, which could throw off their measurements.

If the Hubble-measured distance is right, "that would require a full rethink of the disk instability model," Sivakoff notes.

Fortunately, the stalemate is going to break. Both sides of the debate are looking forward to the European Space Agency's Gaia, which will launch this October. Long awaited by astronomers worldwide, the astrometry mission is the successor to the epochal Hipparcos star-position measuring satellite of the 1990s. Over a 5-year period, Gaia will map out far more precise positions and motions for 1 billion stars in our sector of the galaxy. Gaia is certain to revolutionize all aspects of stellar astronomy, and in this case, "Gaia will ultimately provide the answer," Harrison says.

This content distributed by the

AAVSO Writer's Bureau

Southern Skies Observing Adventure

March 29—April 5, 2014

By John Bambury, 3 Rivers Foundation

John Bambury is one of the Core 4 Volunteers for 3RF Australia, which is the Australian partner of the Three Rivers Foundation of Texas.

Like 3RF Texas we are a non profit organization, focused on providing astronomical education and outreach services to the community.

From March 29, 2014 to April 5, 2014 we will be hosting the 11th Annual Ozsky Star Safari, at Coonabarabran NSW. The Ozsky Star Safari was first held in 2004 and was previously known as the Deepest South Texas Star Safari. It has been held at least annually every Australian autumn and on four occasions we have also held a spring event, for people wishing to view different aspects of the Southern Skies.

The Ozsky Star Safari provides a unique observing opportunity for Northern Hemisphere observers. We provide several large aperture high quality visual telescopes (Obsessions), for use by the attendees and always have some experienced volunteers on hand every night, who provide guidance in using the scopes and in finding the Southern targets, if required. In addition they also provide a unique Australian cultural experience by assisting in arranging various daytime activities, tours, and dining experiences. By the same token the event is fairly unstructured, so participants can pick and choose what things they participate in.

The Ozsky Star Safari numbers are limited to 30 astronomers, plus spouses/partners. This ensures good and ready access to the equipment and plenty of scope time for the attendees. We always run "sky tours" for the non astronomy partners, to enjoy the wonders of the Southern Skies, at their leisure.

We, the 3RF staff, would like to make this Southern Hemisphere Observing Opportunity known to anyone who might be interested in observing the southern skies. The way we structure the trip and supply the equipment, makes the logistics of a southern hemisphere observing



The poster features a dark starry background with a yellow arc at the top containing the text 'OZSKY 2014' and 'THE OZSKY STAR SAFARI'. Below this is a silhouette of a kangaroo looking through a telescope. To the right is a map of Australia with 'COONABARABRAN AUSTRALIA 2014' written on it. At the bottom, the text reads 'AUSTRALIA MARCH 29 - APRIL 5, 2014 SOUTHERN HEMISPHERE AUTUMN', 'WWW.OZSKY.ORG PROUDLY HOSTED BY 3RF AUSTRALIA', and 'EMAIL: INFO@OZSKY.ORG'. On the right side of the poster, there is a section titled 'SOUTHERN SKIES OBSERVING ADVENTURE' with an invitation to join for a week of observing, location details for Coonabarabran, NSW, and contact information for registration.

SOUTHERN SKIES OBSERVING ADVENTURE

You are invited to join us for a week of observing under some of the darkest and most stunning skies in the world.

Located at Coonabarabran, NSW (-31° S), the Astronomy Capital of Australia, numerous large dobsonians ranging from 14" - 30" are provided for your sheer enjoyment.

If you have never seen the Southern Skies, your observing experience is not yet complete!

Registration and further information available at www.OzSky.org

EMAIL: INFO@OZSKY.ORG

Trip very simple and relatively inexpensive, for northern hemisphere observers.

John Bambury (3RF Australia Volunteer)

General Manager

Kiama Leagues Club

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Kiama NSW 2533

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Fax: (02) 4233 1217

Email: jbambury@kiamaleagues.com.au

Shallow Sky Object of the Month

Split this Double Star?

Object: Double Stars — Sissy Haas study

Optics needed: The telescope you have

Why this is interesting

Sissy Haas has written the book *Double Stars for Small Telescopes*, containing over 2100 double stars for your observing program. That ought to keep you busy for a long time. One of the issues with double star observing is which star pairs can be visually split with amateur telescopes. The variables are:

- Difference in brightness (delta magnitude)
- Separation in the sky (usually in arc-seconds)
- Telescope used (aperture and magnification)

This is a long discussed topic among double star observers without but no definitive resolution of the problem has been reached. We can't say, for example, that you should be able to split a double star pair with a difference in brightness of 1 magnitude, and a 1 arc-second separation, with a 100mm telescope. Sissy Haas is working on figuring this out, and she is doing so by engaging the amateur community to provide a large number of observations with various telescopes. (See the September, 2012 *Sky and Telescope* magazine for her article on this program, but be aware that the observing list has been updated since the article was published. See the web site below for the most-current list.)

http://www.billboblitz.com/Haas_Project/hbsop_index.html

There's a lot of information on this site about the stars that are included in the program and the various ways to identify them. Like most objects in the sky, stars are in multiple catalogs so they have a lot of different identifiers. There's information on how to send observations into the program (via email to Sissy) and a lot more. The site is run by Bill Boulitz and Sissy Haas

The key information on this web site is contained in the 'Master Table' which lists all the stars in the program by delta magnitude and separation. You're certainly welcome to try all of the stars in the table that are within the range of the equipment you have. There is also information from observers—who split which pair with what telescope.

Why not try **90 Her** the next time you're out? The pair has a separation of 1.5" and a delta magnitude of 3.5. The star is located at RA 17h 53m 18s, DEC 40 degrees 00m 29s. The individual stars are 5.3 and 8.8 magnitude. You'll need a dark-enough night and/or a large-enough-aperture to see the 8.8th magnitude secondary star.



Finder chart for 90 Her.

Star chart generated by TheSkyX © Software Bisque, Inc. All rights reserved. www.bisque.com

This star transits at about 11:30 p.m. in mid July, so it's well placed for viewing. The web site provides the information you need to submit your observation to Sissy, including her email address.

Double star observers usually want to acquire what's called the 'position angle' between the two stars of the double. North is at 0 degrees, east is at 90 degrees, etc. This information can be used to determine the orbital period of the double star. For this study, that information is not required.

Parking at the University of Houston Main Campus

For the monthly Houston Astronomical Society Meeting

The large-scale map at the right shows the location of the 15F parking lot, on the west side of Cullen Boulevard.

The detail map (below) was provided by the University of Houston Parking department to define the area that is available for parking while attending the Houston Astronomical Society monthly meeting. This parking is available from 6:30 p.m. until 10:00 p.m. on the Friday night of the HAS meeting (usually the first Friday of the month).

This parking is free. If you get a notice from the UH campus police on the night of the meeting, call the UH Security office and let them know that this area has been made available on HAS meeting night by the Parking Department.



From Google Maps



Houston Astronomical Society

P.O. Box 20332

Houston, TX 77225-0332

General Membership Meeting

The Houston Astronomical Society holds its regular monthly General Membership Meeting on the first Friday of each month, unless rescheduled due to a holiday or a conflict with other events at the University of Houston.

Board of Directors Meeting

The Board of Directors Meeting is held on dates and at locations scheduled by the board. Information provided to *GuideStar* will be published. The meetings are open to all members of the Society in good standing. Attendance is encouraged.

GuideStar Information

The H.A.S. *GuideStar* is published monthly by the Houston Astronomical Society. All opinions expressed herein are those of the contributor and not necessarily of Houston Astronomical Society. The monthly Meeting Notice is included herein. *GuideStar* is available on the HAS web site to all members of H.A.S., and to persons interested in the organization's activities. Contributions to *GuideStar* by members are encouraged. Electronic submission is helpful. Submit the article in text, MS-Word format via email BillPellerin@sbcglobal.net. Copy must be received by the 15th of the month for inclusion in the issue to be available near the end of the same month. Or, bring copy to the General Membership Meeting and give it to the Editor, or phone to make special arrangements.

Editing & Production: Bill Pellerin,

713-880-8061

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Advertising: Advertisers may inquire concerning ad rates and availability of space.

The Houston Astronomical Society welcomes you to our organization. The HAS is a group of dedicated amateur astronomers, most of whom are observers, but some are armchair astronomers.

The benefits of membership are:

- Access to our 18 acre observing site west of Houston -- a great place to observe the universe!
- A telescope loaner program -- borrow a HAS telescope and try observing for yourself!
- A monthly novice meeting, site orientation meeting, and general meeting with speakers of interest.
- Opportunities to participate in programs that promote astronomy to the general public (such as Star Parties at schools)
- A yearly all-clubs meeting for Houston area organizations
- Meet other amateurs and share experiences, learn techniques, and swap stories

You're invited to attend our next meeting.

You'll have a great time.

Houston Astronomical Society

Meeting on Friday, July 5, 2013

7:00 Novice Meeting, room 116 Science & Research 1 Bldg

8:00 General Meeting, room 117 Science & Research 1 Bldg

University of Houston

Directions to meeting:

From I-45 going south (from downtown)

- exit at Cullen Boulevard
- turn right on Cullen
- turn right into the parking lot (past the parking garage)
- Science and Research is across the street (2nd building back)

From I-45 going north (from NASA/Galveston)

- exit at Cullen Boulevard
- turn left on Cullen
- turn right into the parking lot (past the parking garage)
- Science and Research is across the street (2nd building back)

Parking:

There is Free Parking. **See Parking map on preceding page.**
U of H parking enforcement will ticket your vehicle.

UPDATE — Use entrance 15F. You can park in this area, but NOT in a RESERVED space.