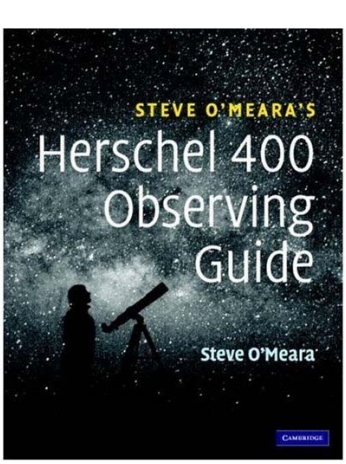
# Starscan

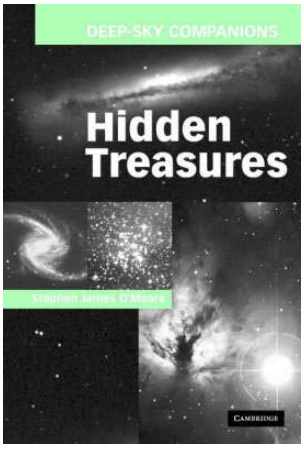
## Johnson Space Center Astronomical Society

Volume 23, Number 10 October 2007

"Comets and the Witch Hysteria of 1692"




**ALL-CLUBS' MEETING AND ASTRONOMY DAY 2007 SPEAKER**



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## Message from the el Presidente
## REMINDER FROM BOB TAYLOR

**7th Annual Houston/Beaumont Regional Astronomy Meeting**
Friday, October 19, 2007
Houston Community College
Host: Fort Bend Astronomy Club
8:00 - 10:30 PM

**Astronomy Day 2007**
Saturday, October 20, 2007
The George Observatory
Brazos Bend State Park
3:00 - 10:00 PM

**Fort McKavett (bi-annual gathering)**
October 11-14
See ya there!!

## Letter from the Editor
By Connie Haviland

This month's edition of the Starscan will include information about our speaker for the 2007 Astronomy Day and All-Clubs meeting that is scheduled for October. I will be including more information about Astronomy Day, next month. I thought it would be good to have an article regarding the speaker, for those who may not know who he is (I doubt that, but I like to cover all possibilities). This way, in October, when he is here in Houston, you can prepare any questions to ask him at the meeting or at the George Observatory.

Also, please note that I do not have a crossword puzzle for this month. I apologized, but it seems that the crossword puzzle creator I have, makes mistakes and we cannot have that. I will be looking for another one, so be patient and I will have this feature back ASAP.

**********

## Star Party Dates—2007
By John Erickson

**October 11 – 14, 2007 Fort McKavett**

**October 19, 2007 All Clubs Meeting**

**October 20, 2007 Astronomy Day at the George Observatory**

**November 10, 2007 Haak Winery**

## LPI– FAMILY NIGHT
By Matt and Lisa Hommel

**October 6th-7 to 10 pm.**
Those who wish to bring scopes should show up at least 30 minutes before sundown. Matt Hommel is there around 5pm if you want to get there early

## Steve O'Meara—Astronomy Day 2007 Speaker

Steve O'Meara on the rim of Kilauea Crater in Hawaii with Pele and his Tele Vue Genesis refractor. *Photo by Donna O'Meara.*

A superb writer, photographer, and naturalist, Steve O'Meara is also known worldwide for his legendary eyesight and observing prowess. Among his many astronomical achievements: he was the first to sight Halley's Comet visually on its 1985 return; he noticed the dark "spokes" in Saturn's B ring before the Voyager 1 spacecraft imaged them; and he was the first person to correctly determine the rotation period of the distant planet Uranus. His remarkable skills (including seeing 8th-magnitude stars with his unaided eyes) continually reset the standard of quality for other observers.

Steve earned a Bachelor of Science degree from Northeastern University and has spent most of his career on the staff of *Sky & Telescope*, where he is now a contributing editor. Among his many accolades, the Texas Star Party (TSP) gave him its highest honor, the Lone Stargazer Award, "for setting the standard of excellence in visual observing." The TSP also gave him its Omega Centauri Award for "advancing astronomy through observation, writing, and promotion, and for sharing his love of the sky," and the International Astronomical Union named asteroid 3637 O'Meara in his honor.

When not looking skyward from his home on the Big Island of Hawaii, Steve enjoys traveling the world with his wife, Donna, to document volcanic eruptions. *National Geographic Explorer* produced a movie ("Volcano Hunters") about the O'Mearas' research, and Sky Publishing Corp. published their book *Volcanoes: Passion and Fury* in 1994. Steve is author, coauthor, or editor of many astronomy books, including *Deep-Sky Companions: The Messier Objects*, *Deep-Sky Companions: The Caldwell Objects*, *Deep-Sky Wonders*, and *Mars: The Lure of the Red Planet* (with William Sheehan). Article from http://www.skyandtelescope.com/about/generalinfo/3305266.html

**Books authored by Stephen James O'Meara:**

Deep-Sky Companions: Hidden Treasures (Deep-Sky Companions) (May 7, 2007)
Deep Sky Companions: The Messier Objects (Deep-Sky Companions) (July 2000)
Steve O'Meara's Herschel 400 Observing Guide (Hardcover - Jul 31, 2007)
Deep-Sky Wonders (Stargazing) with Walter Scott Houston (Paperback - May 4, 2005)
Deep-Sky Companions: The Caldwell Objects (Deep-Sky Companions) (Hardcover - Feb 3, 2003)
Stargazing with Jack Horkheimer: Cosmic Comics for the Sky Watcher by Jack Horkheimer, Stephen
James O'Meara, and Rich Harrington (Hardcover - Feb 15, 2007)
Mars: The Lure of the Red Planet with William Sheehan (Hardcover - April 2001)
Volcanoes: Passion and Fury by Stephen James O'Meara and Donna Donovan-O'Meara (Paperback - Jun 1994)
Deep Sky Companions: The Messier Objects (Hardcover - Dec 28, 1998)

COMING OUT:
Steve O'Meara's Observing the Night Sky with Binoculars (Hardcover - April 1, 2008)

# A FEW STORIES FROM OUR CLUB MEMBERS WHO KNOW STEVE

The following are Steve at Texas Star Party stories.

Steve, David Levy, Shane & I were having a nice leisurely lunch at the Drugstore in Fort Davis during a TSP of several years ago. The Drugstore is a popular hangout for hungry astronomers during TSP week, and is normally packed with star gazers from around the planet. We were all having a lively conversation, as we always do during our lunches together and a patron---an obvious fan of Steve's--- kept interrupting our lunch. He was basically stalking Steve, and even followed us across the street to the Limpia Hotel where I was going to make a portrait of Steve and David.

This guy just kept hanging around and following Steve's every move and kept trying to engage Steve in conversation. It was very disruptive and Steve was ever gracious, but after a while it was just more than enough.

Finally, Shane went to get Steve's car while I distracted the stalker so Steve and David could make a get-away back to the ranch.

A more recent Texas Star Party found Steve doing his usual hanging out and observing with Larry Mitchell. Shane & I walked to where they were observing through Larry's scope and noticed they were both wearing sunglasses in the DARK! When asked why they were wearing sunglasses, Steve's reply was "because we can". They were looking at bright planetary nebula and the polarized sunglasses were enabling them to see more detail in the objects. It was quite a funny sight though, because it reminded me of two aliens with big eyes when I saw them together that night.

Steve is a special friend of ours and we always enjoy his visits and challenges when he comes to Texas. He has made us ponder the universe in ways we may not have otherwise. He has also made us laugh so hard that beverages have come through our noses.

Becky Ramotowski

# CHARLIE'S CHALLENGE

In Bob Taylor's August presentation on space missions that are soon to be launched, he pointed out that some of the craft will have a final stage that is powered by an ion engine with a few hundred pounds of xenon as a propellant. Ion engines have been discussed since the early 1960s, but I wasn't sure they had ever been developed to the point that they could be used. The difficulty with chemical propellants is that the ultimate speed of a craft propelled by them is limited by the exhaust velocity that they have. Those of you with a technical bent might try to derive a formula for the velocity of a single-stage spacecraft powered by expelling mass out the back of the craft. If you do, you will see what I mean.

The idea behind an ion engine is to make some ions, accelerate them with an electric field, and let them fly out the back of the craft. With sufficient voltage the exhaust velocity can be made very high. Generally speaking, positive ions are easier to make than negative ones, and that is certainly true with xenon. The difficulty with this concept is that once a positive ion has left the spacecraft, it is attracted back to the very negative electrode that accelerated it. That slows the craft down, so for the ion engine to work, some means of neutralizing the ion must be found, preferably as close to the negative electrode as possible.

**Charlie's Challenge:** How is the neutralization of the ions expelled as propellant from the ion engine accomplished? I do not know the answer to this one, either.

**Partial Answer to last month's Challenge (sent to me by Charlie)**: The person who first explained lateral chromatic aberration to me was Matt Delevoryas. I know he has something of a reputation as a joker. I have never caught him dealing with me this way. If he has done so with the other members, it is unfortunate, because the act has obscured the talents of a very smart guy.

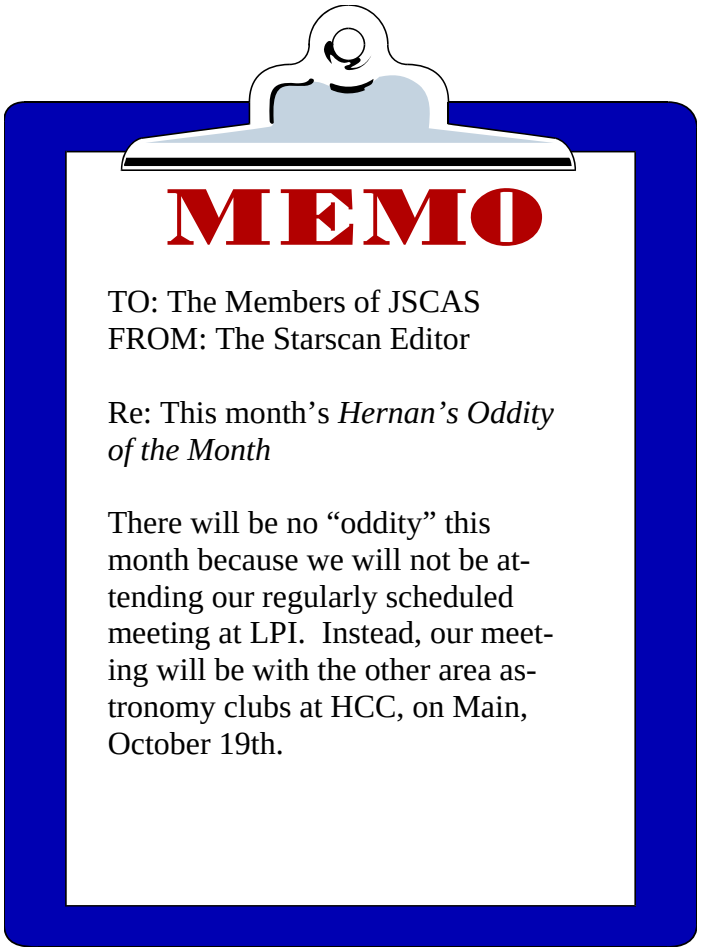
**RESPONSE TO LAST MONTH'S CHALLENGE**

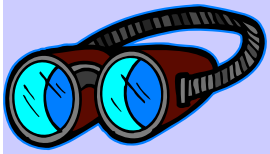
**CHARLIE MUST HAVE STUMPED THE CLUB THIS PAST MONTH**

**NO ANSWERS HAVE BEEN SUBMITTED TO ME…**

## *HERNAN'S ODDITY OF THE MONTH*

By Hernan Contreras





## FORT (Forward Observing Recon Team)

By Ken Lester (special operations team)

To say I'm eager to see everyone again is an understatement! It's hard to believe we've been coming out to the fort for 10 years now. It boggles the mind to think that I've been living out here for a year and a half already.

This October's star party should be a good one. There will be one big difference this fall. Because of all the moisture you will all want to come prepared with dew shields, hair dryers and OFF. Just this past week we've had fog in the mornings. Hopefully all the hard rains are over. Our rain last week was only 0.14 inches. The good side of the rain is all the wonderful green color at the fort. Be sure to visit the springs, but spray for ticks first. The springs are literally gushing from the ground now.
The old top spring that's been silted in for years is full of water.

We are rapidly getting ready for your visit. We have just completed a year long effort to install new display signs around the fort. There are 13 displays scattered over the site. The official grand opening of the new displays is the Saturday of our public star party. Two of these signs are placed in front of the barracks. They are on skids and you have our permission to move them out of the way every night after 5 pm. Just don't take them too far as we will need to put them back out in the mornings.

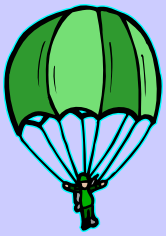
In addition to our grand opening on the displays, Saturday we will be hosting the Fort McKavett Town Reunion. We are inviting former residents to come out to the fort and share their experiences while living at Fort McKavett.

Our great BBQ lunch will once again be held around noon on Saturday. The meal is open to all astronomers, former residents, Friends of Fort McKavett, and the public. The meal is funded by the Friends Group. There is no cost for the meal, but donations are appreciated to help defray the cost of the food and to support various fort activities. In the past JSCAS folks have donated $10 per person toward the meal but the amount you donate or "if you donate" is entirely up to you.

Following the noon meal, the Friends of the Fort will hold their annual meeting at the school house. The meeting is open to all members, future members, and interested public. If you are not already a member or need to renew your membership in this fine organization, you can sign up at the meeting. Our Friends Group is vital to the programs that we have at the fort.

There will also be a silent auction on Saturday. The items available for bid will be located at the school house. The auction will be coordinated this year by our very own Lisa Lester. This is a major Friends Group's fund raising event. As with the BBQ, the proceeds collected help our Friends Group support fort activities. Since I have been working here at the fort, I have seen first hand how much the Friends of Fort McKavett contribute, both monetarily and in donated time. Let Lisa know if you have an item to donate for the silent auction.

At this time, no Saturday evening food concession is being considered. If that changes, I'll let everyone know as soon as I find out. So be prepared with something to eat Saturday evening before the star party.



The skies were beautiful the last few nights. Our first real cool front came through and temperatures got down in the 50's. In another month I expect some real cool weather to show up. So bring your warm clothes and don't forget your warm bedding. Remember, there are no ground fires permitted except in the fire rings in the picnic area and don't use the fireplaces, the chimneys have been capped!

Look forward to seeing you all!

Ken Lester

Thought a few pictures from Ken would get you excited about making the trip this year.

Connie Haviland

Ken said that there will be no cannon this year.


# What's Happening at the George!!!

Cynthia Gustava

## 2007 Astronomy Day

**When:** Saturday, October 20, 2007
Open to the public 3:00 p.m. to 10:30 p.m.
**Where:** George Observatory, Brazos Bend State Park

Volunteer for Astronomy Day to Cynthia Gustava @ **cynm31@comcast.net** … For more information about the All-Club's Regional Meeting, contact Bill Leach at 281-312-1650 or email him at **astrobil@flash.net**. If you are planning on bringing a deck scope, please provide the size and type of telescope, plus whether you will be day or night or both. Keep in mind that the George Observatory has dobsonian's that can be reserved for the night also.

## 2007 All-Club's Meeting

**When:** Friday, October 19, 2007
Refreshments and Registration: 7:30 p.m.
**Main meeting:** 8:00 to 10:15 p.m.
**Main Speaker:** Author, astronomer and photographer, Stephen O'Meara
**Topic:** "Comets and the Witch Hysteria of 1692"

**Where:** Auditorium of the Houston Community College Administration Building, at the intersection of Main and Elgin, downtown Houston.
**Parking:** Parking will be available in the 3100 South Main parking garage at no charge all evening. Parking here is plentiful and safe. Take the garage elevator to the 3rd floor. The sky walk takes you directly to the 2nd floor of the administrative building where the main auditorium is.

A map and directions to Houston Community College, at 3100 Main Street (downtown HCC Campus), can be found at www.astronomyday.org/.
Bring your friends! If your friend joins a club that night, they will be eligible to win a door prize!

Astronomy Day T-shirts will be on sale at the All-Club's meeting at HCC's downtown campus for $15

# OCTOBER OBSERVING

## Fort Mc Kavett Challenge List

★ **SSO**: (Solar System Objects) Summary for the 11 Oct 07

| Object | Const | Mag | % Ill | Rise Time | Transit | Set Time |
|---|---|---|---|---|---|---|
| **Sun** | Vir | -26.7 | 100 | 07:20 | 13:06 | 18:52 |
| **Moon** | Vir | ---- | 3 | 08:36 | 14:02 | 19:30 |
| **Mercury** | Lib | 0.9 | 27 | 08:57 | 14:18 | 19:43 |
| **Venus** | Leo | -4.5 | 41 | 03:56 | 10:18 | 16:39 |
| **Mars** | Gem | -0.3 | 88 | 23:24 | 06:23 | 13:21 |
| **Jupiter** | Oph | -1.9 | 99 | 11:47 | 16:55 | 22:08 |
| **Saturn** | Leo | 0.8 | 100 | 03:58 | 10:25 | 16:52 |
| **Uranus** | Aqr | 5.7 | 100 | 17:15 | 23:06 | 04:53 |
| **Neptune** | Cap | 7.9 | 100 | 15:56 | 21:26 | 02:53 |
| **Pluto** | Sgr | 14:0 | 99 | 12:19 | 17:41 | 23:08 |

Highlighted times denote daylight events.

**Lunar phases for October 07**

| Third | New | First | Full |
|---|---|---|---|
| 3th 05:06 | 11th 00:01 | 19th 03:33 | 25th 23:52 |

Central Daylight time

## ★ Challenge List

Since it is once again the time to enjoy Fort McKavett, so I thought I'd put together a list of interesting objects to look for If you don't already have an observing plan prepared. See the attached list. The objects are listed in RA order.

**NOTE FROM THE EDITOR:**

THE FOLLOWING PAGES HAVE THIS LIST SET UP SO THAT YOU CAN PRINT THEM OUT AND TAKE THEM WITH YOU TO FORT MCKAVETT. I HAVE INCLUDED A LINE TO CHECK OFF WHEN YOU HAVE FOUND THE ITEMI HAVE ROTATED THE LIST SO THAT IT IS IN A LANDSCAPE SET UP. THIS WAY THE LIST IS ALL ON THE PAGE…..

| Object | AKA | Mag | Type | Const | Size/Sep | RA | DEC | # Stars CStr Mag | SA | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| ___NGC 7838 | | 15.3 | MGal | Psc | 1.0'x0.3' | 00h 06m | +08° 21' | | 10 | |
| ___NGC 1 | | 12.8 (V) | Gal | Peg | 1.8'x1.2' | 00h 07m | +27° 42' | | 4 | |
| ___NGC 129 | | 6.5 | OCL | Cas | 21' | 00h 29m | +60° 13' | 35 | 1 | |
| ___G 1 | | 13.7 | GCL | And | 0.5'x0.5' | 00h 32m | +39° 34' | | 3 | |
| ___NGC 224 | M 31 | 4.4 (B) | Gal | And | 192'x62' | 00h 42m | +41° 16' | | 4 | |
| ___NGC 253 | C 65 | 7.1 | Gal | Scl | 28' x 7' | 00h 47.6m | -25° 17' | | 18 | Sculptor Galaxy |
| ___NGC 288 | | 8.1 | GCL | Scl | 130' | 00h 52m | -26° 34' | | 18 | |
| ___NGC 300 | | 8.7 (B) | Gal | Scl | 22'x16' | 00h 54m | -37° 40' | | 23 | |
| ___IC 1639 | | 9.9 (B) | Gal | Cet | 16'x14' | 01h 04m | +02° 07' | | 10 | |
| ___NGC 404 | H-224-2 | 12 | Gal | And | 4' x 4' | 01h 09.5m | +35° 43' | | 4 | next to beta |
| ___NGC 457 | C 13 | 6.4 | OC | Cas | 13.0' | 01h 19.1m | +58° 20' | 80 | 1 | ET!, Owl Cluster, Phi Cas Cluster |
| ___NGC 581 | M 103 | 7.4 | OCL | Cas | 6.0' | 01h 33m | +60° 39' | 25 | 1 | |
| ___NGC 654 | | 6.5 | OCL | Cas | 5' | 01h 44m | +61° 53' | 60 | 1 | |
| ___NGC 663 | | 7.1 | OCL | Cas | 16' | 01h 46m | +61° 13' | 80 | 1 | |
| ___IC 5146 | C 19 | 10 | BN | Cyg | 12 x 12 | 01h 53.5m | +47° 16' | | | Cocoon Neb |
| ___NGC 884 & ___NGC 869 | | 6.1, 5.3 | OCL | Per | 29', 29' | 02h 20m | +57° 08' | 150, 200 | 1 | |
| ___Cr 26 | | 6.5 | OCL | Cas | 21' | 02h 32m | +61° 27' | 40 | 1 | |
| ___Sh2-155 | C 9 | 7.7 | BN | Cep | 50 x 10 | 02h 56.8m | +62° 37' | | | Cave Nebula |
| ___NGC 1360 | | 9.6 (P) | PLN | For | 6.4' | 03h 33m | -25° 52' | 11.3 | 18 | |
| ___IC 405 | C 31 | 6 | BN | Aur | 30 x 19 | 05h 06.2m | +34° 16' | | | Flaming Star Nebula |
| ___NGC 1904 | M 79 | 7.7 | GCL | Lep | 9.6' | 05h 24m | -24° 31' | | 18 | |
| ___NGC 1976 | M 42 | 3 | BRN | Ori | 60' | 05h 35m | -05° 25' | ---- | 11 | |
| ___NGC 2392 | C 39 | 9.9 | PN | Gem | 47" x 43" | 07h 29.2m | +20° 55' | | 5 | Eskimo Nebula |
| ___NGC 2419 | | 10.3 | GCL | Lyn | 4.6' | 07h 38m | +38° 52' | | 5 | |
| ___NGC 3587 | M 97 | 11.2 | PN | UMa | | 11h 04.8m | +55° 01' | | | !! Owl Nebula, appears brighter than 11.2m |
| ___NGC 6210 | | 9.3 (P) | PLN | Her | 30" | 16h 44m | +23° 47' | 12.6 | 8 | |
| ___NGC 6229 | | 9.4 | GCL | Her | 4.5' | 16h 46m | +47° 31' | | 8 | |
| ___NGC 6543 | C 6 | 8.8 | PN | Dra | 24" | 17h 58.6m | +66° 38' | | | Cat Eye Nebula |
| ___NGC 6523 | M 8 | 5.8 | BN | Sgr | 90' x 40' | 18h 03.8m | -24° 23' | | 22 | !! Lagoon Nebula with open cl. NCG 6530 |
| ___B 86 | | | DN | Sag | 4 x 6 | 18h 03m | -27° 50' | | | B 86 |
| ___NGC 6572 | | 9.0 (P) | PLN | Oph | 11" | 18h 12m | +06° 51' | 13.1 | 16 | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| ___Cr 399 | | 3.6 | OC | Vul | 60.0' | 19h 05.4m | +20° 11' | 40 | 8 | Coathanger |
| ___NGC 6826 | C 15 | 9.8 | PN | Cyg | 27" x 24" | 19h 44.8m | +50° 31' | | 3 | Blinking Planetary |
| ___NGC 6822 | C 57 | 9.3 | Gal | Sgr | 10 x 9 | 19h 44.9m | -14° 48' | | | Barnard Galaxy |
| ___NGC 6853 | M 27 | 7.6 (P) | PLN | Vul | 6.7' | 19h 59m | +22° 43' | 13.9 | 8 | |
| ___NGC 6913 | M 29 | 6.6 | OC | Cyg | | 20h 03.9m | +38° 32' | | | small, poor open cluster 2° S of (Gamma) Cygni |
| ___NGC 6888 | C 27 | | BN | Cyg | 20' X 10' | 20h 12m | +38° 23' | | | Crescent Nebula |
| ___NGC 6934 | C 47 | 8.9 | GC | Del | 5.9' | 20h 34.2m | +07° 24' | | 16 | |
| ___NGC 7000 | | ---- | BRN | Cyg | 120' | 20h 58m | +44° 20' | ---- | 9 | |
| ___NGC 7006 | C 42 | 10.6 | GC | Del | 2.8 | 21h 01.5m | +16° 11' | | | |
| ___NGC 7009 | C 55 | 8.3 | PN | Aqr | 44" x 23" | 21h 04.2m | -11° 22' | | 16 | Saturn Nebula |
| ___NGC7015 | | 13.3 (B) | Gal | Equ | 1.5'x1.5' | 21h 05m | +11° 24' | | 17 | |
| ___NGC 7078 | M 15 | 6.4 | GC | Peg | 12.0' | 21h 30.0m | +12° 10' | | 16 | Rich, compact globular |
| ___NGC 7089 | M 2 | 6.6 | GCL | Aqr | 16' | 21h 33m | -00° 49' | | 17 | |
| ___NGC 7099 | M 30 | 6.9 | GCL | Cap | 120' | 21h 40m | -23° 10' | | 18 | |
| ___NGC 7293 | | 7.5 (P) | PLN | Aqr | 16' | 22h 29m | -20° 50' | 13.5 | 17 | |
| ___NGC 7380 | | 7.2 | OCL | Cep | 12' | 22h 47m | +58° 06' | 40 | 3 | |
| ___Pal 13 | | 13.8 | GCL | Peg | 0.7' | 23h 06m | +12° 46' | | 10 | |
| ___NGC 7635 | C 11 | 8.5 | BN | Cas | 15 x 8 | 23h 21m | +61° 12' | | | Bubble Nebula |
| ___NGC 7654 | M 52 | 6.9 | OCL | Cas | 12' | 23h 24m | +61° 35' | 100 | 3 | |
| ___NGC 7662 | C 22 | 8.3 | PN | And | 32" x 28" | 23h 25.9m | +42° 33' | 13.2 | 9 | Blue Snowball |
| ___NGC 7686 | | 5.6 | OCL | And | 14' | 23h 30m | +49° 07' | 20 | 9 | |
| ___NGC 7789 | | 6.7 | OCL | Cas | 15' | 23h 57m | +56° 43' | 255 | 3 | |

# GIGO and GOTO's

By Chuck Shaw

The JSCAS listserver had a thread of notes recently that members contributed their thoughts about GOTO scopes. I found this thread to be very interesting, and share several member's observations about the hype for GOTO mounts and the expectations where one can simply plop down and push a few buttons and bingo you can find any thing (and SEE it under any sky conditions)..... With any sophisticated tool (atelescope, a VCR, or a lathe, etc.), to use it correctly you need to stop and understand a bit about it (NOT everything, and certainly NOT the minutia). But you do need to know what things are important to get that first 75% of its performance, which is usually more than most folks need on a routine basis. That last 25% of performance is usually a longer learning curve and addresses the more arcane aspects....

Since I have helped develop computer controlled telescope drive software for a long time now, and have built and use several computer controlled scopes, I have some observations and suggestions to add to the accumulated knowledge shared on the listserver thread of notes.....

Like anything having to do with a computer (or micro-processor, etc.), the cardinal rule is: "garbage in produces garbage out"..... (GIGO)..... So what do you have to ACCURATELY tell your computer controlled mount to get it to track ACCURATELY, and to do GOTO's ACCURATELY???

To start with, you need to be able to operate the mount's controls accurately! That is code for READ THE MANUAL, several times probably!!! Put sticky notes on the parts that seem strange or important and read those till you understand them, or ask questions on them till you DO understand them.....

To begin with, if it's an "equatorial" mount (horseshoe, fork, German eq, etc. that has one axis aimed at the North Celestial pole), it needs to be polar aligned accurately! The more accurate the polar alignment, the better the subsequent performance..... For visual observing (but not GOTO's), the polar alignment can be a couple of degrees off, since you can recenter occasionally. Imaging requires that you be very accurately aligned (within a few arcminutes at most) to get good performance. ACCURATE GOTOs also require alignment to within a few arcminutes. Think about it, the math in the software is depending on knowing accurately where that RA axis is aimed, and if it does not, then you get GIGO.....

You do NOT need to see Polaris to polar align. Read up on doing a "drift align". In almost all cases, it is much more accurate than most any other approach..... Practice doing it so it becomes second nature and is not frustrating to do.....

Very good advice in the thread of notes was to get an eyepiece with a reticule. You can make one with some really, really fine wire glued to the field stop of a cheap eyepiece (the quality of the view is unimportant!). Use something that gives medium power.... The Houston light pollution will allow you to see the crosshair against the bright night sky. Darker skies will require using an illuminated reticule eyepiece to see the reticule (especially with old eyes like mine!!)

Make sure things are fastened together snugly. I mean EVERYTHING!!! Do not "over-tighten", but verify nothing is loose. Go over everything..... A floppy connection between the mount and scope, or the optics within the scope will make things move around and really frustrate you and you get..... GIGO! Loose means even a few thousandths of an inch of play for some components..... Tube sag and such, like was mentioned in the thread, becomes a factor when trying to put a dim fuzzy into the field of view of a tiny CCD chip. Consider this as part of that last 25%. Walk before you run, and do your GOTOs with a low power eyepiece installed, and have a good finder that is securely attached and co-aligned with the main scope optics since it will have a larger FOV in case the GOTO misses a little.....

As part of this bolt tightening exercise, make very sure that the scope is well BALANCED!!!!! For an alt/az, that is primarily for the altitude axis. Declutch to make sure it is balanced throughout its entire range of motion! For an equatorial mount, you MUST balance it about the RA axis and also about the Dec axis. Again, declutch!!!!! If you eventually do photography you will want to subsequently actually introduce a little imbalance about the RA axis, but that is in that 25% of stuff to deal with! When you de-clutch, to test the balance, if the mount does not move smoothly, find out why! Does it need lubricating someplace? Is something binding? Fix this before moving on..... details, details, details..... (GIGO, GIGO, GIGO.....) While on the topic of balancing, try not to overload the mount with a heavy scope. If you stay within the rated capacity of the mount, it will perform better! Longer scopes (like medium sized Newtonians) on equatorial mounts are less forgiving of violating the mount capacity. Imaging is also less forgiving of pushing the capacity. And no matter what, when you are at or above the mount's capacity, balance becomes much more critical…

Now that things are snug and balanced, re-collimate the scope. And make sure it is well collimated every time you use it! Two reasons: 1) the images are better! 2) with collimation is off, the optical axis will have shifted from the mechanical axis of the scope, so you will be lying to it again about where the mechanical axis is aimed, especially if you have previously corrected for non-orthagonal axes, etc. (which are part of that final 25% stuff).

Last thing for the mount, for accurate tracking and GOTOs, the microprocessor needs to know how much the mount moves for a given command it sends to the motors. Most commercial mounts already have this programmed in, but sometimes not... Also, if the mount has encoders, they also may need to be calibrated. This is NOT a calibration like Periodic Error Correction (which corrects for gear errors, and is NOT required for GOTO or even for most visual observing). PEC is one of those extra 25% thingies when you get into imaging.

Learn the night sky enough to be able to reliably find where Polaris is, and the major constellations and what there stars are. That does NOT mean MEMORIZE the whole sky!!! Only a few gifted people like Al Kelly have the entire sky memorized..... The rest of us use star charts (either paper or a PC). I recommend paper initially (the batteries last longer <grin>). Do NOT use your scope.... use a pair of binoculars only.... And go out EVERY night for at least 5 minutes just to practice using your star chart to reliably find the major stars. Why do this????? Tell your scope you are on Altair when the scope is actually on Vega and watch what happens to your GOTO accuracy. You guessed it! GIGO.....

For most GOTO scopes, you need to tell your scope what time it is, and where it is!! Time usually only needs to be within a minute or so, but more accurate is better. Use "Atomic Clock" (free web based time hack s/w you can Google for to find and download), and set your watch by it. Then set the mount's clock (assuming it has one.... not all do, since the software routines used vary.... but if it DOES need an accurate time, and you lie to it..... GIGO.....

Virtually all GOTO control s/w needs to know its location however (again, not all do, but most do...) The GPS scopes on the market get time and location automatically. However, you can use Microsoft's TerraServer http://terraserver.microsoft.com/default.aspx to get your lat/Long of where you are observing.

So now the scope is polar aligned (or is sitting reasonably level for an alt/az), it knows where it is and what time it is, the scope and optics are all snugged down and aligned, and now its time to initialize the mount. What that means is to give it info it will use to transform the mount location and the positions of its axes, to positions in the sky. This is called a transformation matrix (but all you need to know is it's the math routine the mount will be doing, and if you feed it incorrect info.... you guessed it: GIGO!! So that's why you want to make sure you know what the object is you are telling the mount is aimed at!!!

Most equatorial mounts that are accurately polar aligned will only need to be aimed at ONE star (since it already knows where the RA axis is aimed, and you told it the time and its location…). Do NOT make that one star you aim at Polaris!!!! Tiny errors in centering Polaris can introduce huge errors in RA, and guess what..... GIGO..... Use your reticule eyepiece and aim at something near the celestial equator where tiny errors in centering are more forgiving! For a GEM, if you want to do a meridian flip (i.e. look at something in the west when the scope is currently aimed at something in the east), you will probably have to do another initialization on the other side of the meridian, since things get a bit reversed. Forks and horseshoe mounts don't have this meridian flip thing to deal with..... But they have their woes to come to grips with too.

Alt Az mounts do their initializations differently, depending on the software they are using and the algorithms used in that software. Some require a level surface, and some do not (although the more level the better). Read the manual to find out! Some will require aiming at the North Celestial Pole (which is NOT Polaris!!!!!!!), and then straight up along the Azimuth axis (which is NOT the zenith (i.e. straight up) unless the mount is perfectly level. Some need to know their altitude and azimuth positions first (for this you CAN aim at Polaris, and then enter your latitude (which will be close to the altitude of Polaris), and zero for the azimuth. This can end up being almost a degree off, for these entries, but s/w routines that use this approach were written by a guy named Taki, and are very tolerant of errors for this initial alt/az input. However, now you must aim the scope at least two stars (some routines require three), and tell the mount its aimed at them (this is called initializations, or inits). Use your reticule Eyepiece!!!! The trick for this is when you are using a 2 star init, is to make them about 90 degrees apart in azimuth, and about at the same altitude (not super critical, but this geometry makes the math more accurate). Stay AWAY from Polaris..... Also, for these initialization stars for an alt/az, stay away from the zenith! When you move between stars, you must slew the mount with the motors if you do not have mount encoders (this goes for the equatorial mounts also!) If you use the 3 star init, make the 3 stars separated by about 120 deg, and again, at about the same altitude. Routines that use the 3 star init are much more sensitive by the way to lining up the stars accurately!!!

The newer alt/az mounts do some of these things "automatically" for you (the GPS mounts for instance automatically determine their Location and time, and all you need to do is aim them to the north (usually) and have them reasonably level. They will then slew themselves to their init stars based on their predictions of where things "should" be in the sky. You look in the eyepiece (use a reticule!) and tweak the position, and say OK. It will then slew to another star or object, and you again tweak, and verify, and then you are off to the races. You still need to do things like make sure the collimation is accurate and things are all "snugged" down. Really sweet, but these mounts are much more expensive.... And if you lie to them for the few things you must tell it, you will get the dreaded GIGO. You are simply paying more for a mount that has fewer opportunities for you to lie to it!! <grin>

Even the new mounts, if they are equatorial mounts, will need to be polar aligned. The newer software for polar alignment works really well, IF all the other mechanical stuff and basic info has been entered correctly.

It will even tell you very accurately how much to move the mount to achieve accurate polar alignment. However, a simple drift align is the acid test, and even though I have helped develop routines for some of the polar alignment software I use, I still do a drift alignment to get it right with the least hassle, (although it IS fun to use the software!!!)

There are some really fine add on capabilities to existing mounts (equatorial and dobs) like Argo Navis and other more basic digital setting circles that give you "push to" capability that works great, but for the most part they are subject to the same things that mounts with motors have when doing GOTOs.

And after all of this, it may make you wonder if all of this high powered capability is really worth it? Well, that is literally and figuratively “in the eye of the beholder”. Under a dark sky, and not under any pressure by others to “show me something daddy!!”, star hopping to faint little fuzzies is really satisfying! But under Houston’s light pollution, or jumping from target to target at a star party with a line of folks waiting to see things, well, a GOTO scope is really hard to beat…..but the bottom line is there are some "basics" that MUST be done if your mount is to perform to your expectations, other wise you will get.... you guessed it..... GIGO

Hope this helps!

Chuck

**Meterorite Crashes in Southern Peru**
**Paul Maley**
**Courtesy of CNN.com**

**LIMA, Peru (AP)** -- Officials are investigating unconfirmed reports that a meteorite crashed in southern Peru over the weekend and caused dozens of people to become sick. Local media have reported eyewitness accounts of a fiery ball falling from the sky and smashing into the desolate Andean plain near the Bolivian border Saturday morning. Officials have said it was a meteorite.

Jorge Lopez, director of the health department in the southern state of Puno, told The Associated Press on Tuesday that 200 people have suffered headaches, nausea and respiratory problems caused by "toxic" fumes emanating from the resulting crater, which is some 66 feet wide and 16 feet deep.
"This is caused by the gas they have inhaled after the crash," Lopez said, adding that a team of eight doctors was sent to investigate and treat the sick.
But meteor expert Ursula Marvin, cast doubt on that theory, saying, "It wouldn't be the meteorite itself, but the dust it raises."

**The crater is some 66 feet wide and 16 feet deep.**

A meteorite "wouldn't get much gas out of the earth," said Marvin, who has studied the objects since 1961 at the Smithsonian Astrophysical Observatory in Massachusetts. "It's a very superficial thing."
Three geologists from Peru's Geophysics Institute are expected to present a report on the incident on Thursday.

Hernando Tavera, a geophysicist at the institute, said similar cases were reported in 2002 and 2004 elsewhere in southern Peru but never confirmed as meteorites.

**Additional coverage article**

**Meteorite Lands in Puno, Peru Near Bolivia, Citizens Report Radiation Sickness**
C. Haviland
Courtesy of Living in Peru.com

## Peru: Regional Health Director Reports on Health Near Meteorite Crash Site

Health | 18 September, 2007 [ 15:00 ]

(LIP-ir) -- Jorge López Tejada, the Regional Health Director for Puno, Peru has discarded that anyone was seriously affected or has contracted any serious illness because of the object that landed in the town of Carancas on Saturday afternoon.

According to Peru's Andina News Agency, López Tejada stated that there were currently 100 to 150 people being seen for headaches, nausea, dizziness and vomiting at a local medical center.

**(Cont'd on next page)**

"There aren't any serious cases, but the substance from the object could affect (the people) in the long term, that's why apart from these tests, it will be necessary to follow up the cases in the next few months," said López Tejada.

The Regional Health Director stated that not only would the people living closest to where the supposed meteorite landed be observed, but that people in the surrounding areas would also be tested for illnesses.

In addition, it was reported that a health brigade arrived with personnel and medication today. The Regional Director is also expecting the arrival of specialists from Lima and Arequipa who are to evaluate the site where it is thought that the meteorite landed.

López Tejada, who is currently in Carancas, has confirmed that there are very strong odors coming from the supposed meteorite crash site. He has stated that despite the fact that masks are being worn, the odor causes throat irritation and nose itchiness.

Andina News Agency reported that the seven police officers which were hospitalized after collecting samples from the thought-to-be meteorite site, are recovering now that they have been seen by doctors.

**Scientist Confirms Meteorite in Puno, Peru is a Chondrite**

18 September, 2007 [ 18:30 ]

(LIP-ir) -- Peru's official government news agency reported this afternoon that scientists which went to the town of Carancas in the Region of Puno, Peru, have confirmed that the glowing object which fell from the sky on Saturday afternoon was indeed a meteorite.

Volcanologist for Peru's Geological, Mining and Metallurgical Institute (INGEMMET), Luisa Macedo, confirmed that a chondrite meteorite had caused the 17 meter (55 foot) wide and 5 meter (16 foot) deep crater when it landed on earth.

It was reported that with the help of the Desaguadero Municipality, the water would be drained out of the crater to establish the exact size of the hole that was made by the chondrite meteorite.

Macedo explained that the chondrite was not radioactive and did not have any toxic gases or substances which could be harmful to peoples health. On the other hand, Macedo stated that it had not yet been established if the water supply in the province of Chucuito had been contaminated or not.

Aside from the analysis Macedo is performing, the National University of Altiplano, Peru's Nuclear Energy Institute, the National Institute of Natural Resources, the Ministry of Health and a Bolivian university are all taking part in the analysis of the area.

**Peru: Doctors Aid in Rising Number of Illnesses after Meteorite Crash**

19 September, 2007 [ 09:00 ]

(LIP-ir) -- Puno, Peru's Regional Health Directorate reported yesterday that doctors and nurses found it necessary to establish auxiliary medical tents near the health center in Carancas.

**(Cont’d on next page)**

The medical tents were established so as to aid the rising number of people reporting to be sick after a meteorite landed in the area on Saturday afternoon.

According to Peru's La Republica newspaper, due to the high number of illnesses, district authorities are considering placing the town of Carancas, Puno, Peru in a state of emergency. It has been reported that at least 600 people have been affected by the meteorite.

Puno, Peru's Regional Health Director, Jorge López Tejada, reported yesterday that at least 150 people had been seen after having stated they had dermal injuries, were dizzy, nauseous or vomiting.

According to the townspeople, the illnesses began after the meteorite crashed and they began to touch the glowing rock believing it had some type of monetary value. Aside from the hundreds of townspeople that were affected, Tejada reported that 8 police officers had to be hospitalized after having taken samples of the meteorite.

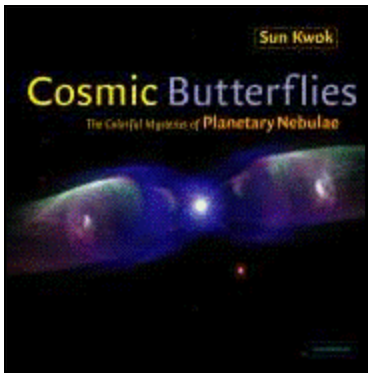
Blood samples are being taken and there are several teams of specialists in the area.

Scientists confirmed yesterday that the meteorite that caused a 17 meter (55 foot) wide and 5 meter (16 foot) deep crater in Puno, Peru was a chondrite meteorite. The water in the crater is to be drained and several teams of scientists from different countries will take samples from the crater itself and from surrounding areas.

Courtesy of www.nuggetshooter.ipbhost.com/index.php?showtopic=11243

# JSCAS LIBRARY

Bob and Karen Taylor




Using more than 100 spectacular images from the Hubble Space Telescope, cosmic Butterflies explores the beauty of the most mysterious celestial objects in space, planetary nebulae. The mystery begins at the end of the star's life, when it wraps itself in a cocoon by spilling out gas and dust. Sometime later, a butterfly-like nebula emerges from the cocoon and develops into a planetary nebula. These newly formed, effervescent structures are complemented by a kaleidoscope of colors emitted by glowing gases. Hovering in the gossamer of delicate streamers, the production of planetary nebula by a star is both its most momentous event and foretells its doom when its central energy runs out. In this extraordinary book, Sun Kwok, a leading international expert on planetary nebulae, details the discovery process of the creation of planetary nebulae and of the future of the Earth's Sun. Sun Kwok is Professor of Astronomy at the University of Calgary and a Canada Council Killam Fellow. His book, *The Origin and Evolution of Planetary Nebulae* (Cambridge, 2000) is widely considered to be the definitive treatise on the subject. He serves as chairman of the Planetary Nebulae Working Group of the International Astronomical Union and has been a member of the Advisory Panel of the Institute of Astronomy and Astrophysics since 1993.

Thought I would put a nice Autumn picture since it is now Autumn..check out those shooting stars. Nice, eh?

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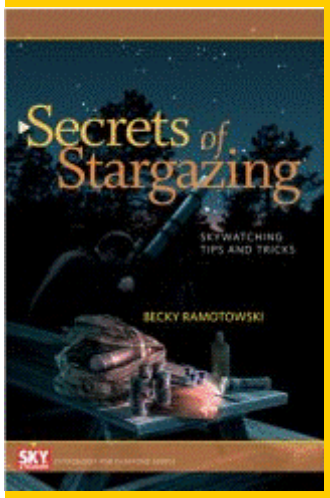
SEE BELOW

## *Secrets of Stargazing*
## By Becky Ramotowski

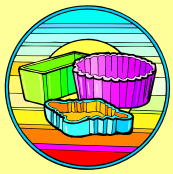



Here's the perfect how-to book for recreational stargazers. It's loaded with practical advice
to help new observers spend more time exploring the night sky and less time fumbling with
equipment or wondering how, when, and what to observe.
IN SECRETS OF STARGAZING YOU'LL DISCOVER HOW TO:
© Quickly get started stargazing if you're the lucky recipient of a new telescope
© Plan your observing sessions and record your observations
© Stargaze in the city—despite the lights
© Quickly and easily set up your telescope
© Use star charts and discover star-hopping
© Decipher weather reports and understand sky transparency and viewing conditions
© Find others in your area who share your love of the night sky.
Whether or not you own a telescope, Secrets of Stargazing is loaded
with tips and tricks that are guaranteed to make you a better observer.
It's a volume that no novice stargazer should be without.

**CHECK IT OUT!!! AND MAYBE GET HER TO SIGN IT AT FORT MAC!!!**

**AN IDEA FOR THE COOKOUT AT THE FORT WHEN EVERYONE GETS TOGETHER AND GRILLS**

**Recipe Summary**
**Difficulty:** Easy
**Prep Time:** 30 minutes
**Cook Time:** 40 minutes
**Yield:** 4 servings



Fire Roasted Chicken with Tamarind-Molasses Glaze
Recipe courtesy Bobby Flay

USER RATING

Tamarind-Molasses Sauce:
2 tablespoons unsalted butter
1/2 cup finely diced onion
2 cloves garlic, finely diced
6 plum tomatoes, coarsely chopped
1/4 cup ketchup
1/4 cup water
2 tablespoons Dijon mustard
2 tablespoons dark brown sugar
3 tablespoons molasses
2 tablespoons tamarind concentrate
1 teaspoon cayenne
1 tablespoon ancho chile powder
1 tablespoon paprika
1 tablespoon Worcestershire sauce
4 bone in chicken breasts
4 chicken thighs
Vegetable oil
Salt and freshly ground pepper to taste
Heat butter in a large saucepan over medium-high heat. Add onions and garlic and cook until soft. Add remaining ingredients and cook for 15 minutes. Place mixture in a blender and blend until smooth. Return to the saucepan exept for chicken and cook an additional 15 to 20 minutes, or until thickened. Preheat grill. Brush chicken with vegetable oil and season with salt and pepper to taste. Grill chicken for 6 to 7 minutes on each side or until golden brown and cooked through. Remove chicken from the grill and brush with the sauce.

## Houston Area Astronomy Clubs

Brazosport Astronomy Club
Meets the Third Tuesday of the month, 7:45p.m.
At the Planetarium
400 College Drive
Clute, Texas (For more information, contact Judi James at the Planetarium 979-265-3376)

Fort Bend Astronomy Club http://www.fbac.org
Meets the third Friday of the month, 7:00 p.m.
First Colony Conference Center
3232 Austin Pkwy
Sugarland, Texas

Houston Astronomical Society http://spacibm.rice/edu/~has
Meets the first Friday of the month, 8:00 p.m.
University of Houston, University Park
Science and Research Building, Room 117

North Houston Astronomy Club http://www.astronomyclub.org
Meets the fourth Friday of the month, 7:30 p.m.
In the Teaching Theatre at Kingwood College
20000 Kingwood Drive
Kingwood, Texas

# Members' Gallery-October 2007
# From Two Points of View

Becky Ramotowski

Totality Lunar Eclipse
Image taken: Aug. 28, 2007
Location: Tijeras, New Mexico
Details: The clouds were insane. There were a few sparse holes that I could capture brief photos of the Moon through. Oddly I could see stars all the way down to the horizon at times.

Edward Malewitz

August 28, 2007 5:00 am CDT
Camera: Canon XTI,
Telescope: Meade LX200 GPS 8"Schmidt at f:6.3
8 second exposure

## Johnson Space Center Astronomical Society

Club Officers

**President – Bob Taylor**
**Vice President – David Haviland**
**Secretary – David Haviland**
**Starscan Editor – Connie Haviland**
**Star Party Chairperson – John Erickson**
**Librarian – Bob and Karen Taylor**
**Historian – Susan De Chellis**
**Scientific Expeditions – Paul Maley**
**Web Master - Chris Randall**

SIGS

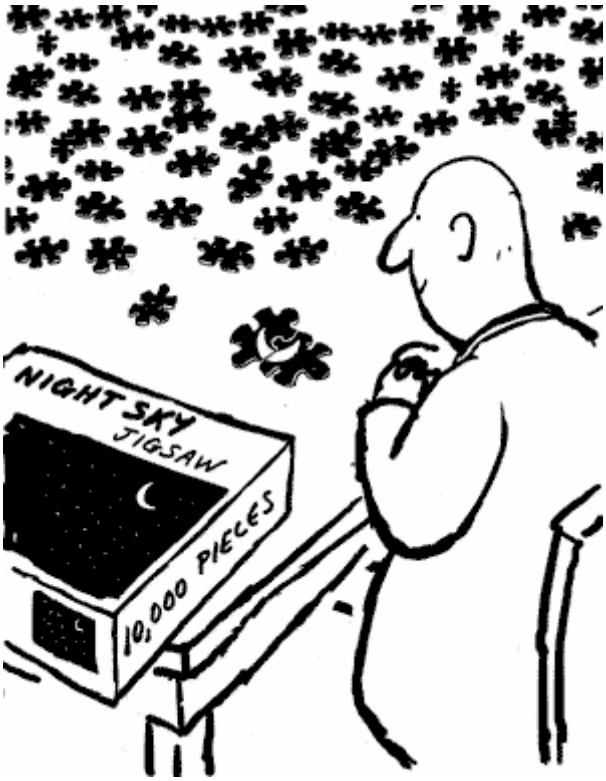
*Observing Awards – Triple Nickel*
*Astronomy 101 — Triple Nickel*
*CCD Imaging – Al Kelly*
*Binocular Observing – Leslie Eaton*
*Telescope Making – Bob Taylor*
*Deep Sky Observing – Chris Randall*

### Starscan Submission Procedures

Original articles of some relation to astronomy will be accepted up to 6 p. m. (1800 hrs) on the 25th of each month. THE most convenient way to submit articles or a Calendar of Events is by email is preferred but hard copies (CD, disk) are also accepted. All articles must include author's name and phone number. Also include any picture credits. Word, WordPerfect, and text files will be accepted.

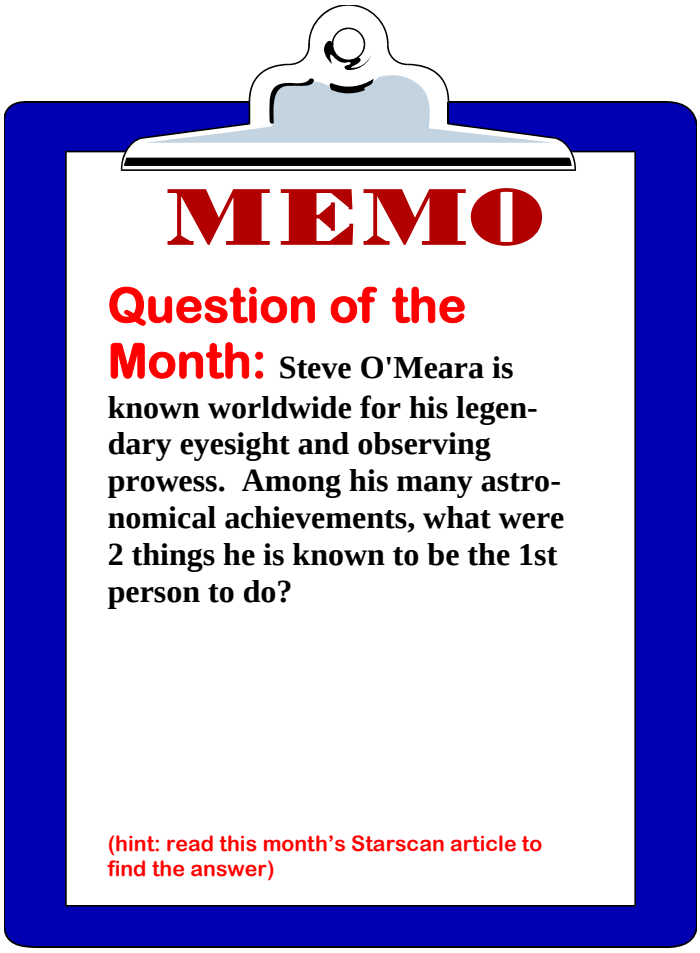
Please send all submissions to:
txcc1234@gmail.com

The author of individual articles bears all responsibility for publishing any e-mail addresses in the article on the World Wide

# Astronomy and Kids

**This is the section strictly for kids (or kids at heart). We will be including information, stories, ideas, puzzles or anything that has to do with astronomy. The only difference here is, it will be directed for children. We don't discourage parents or any other adult to get involved. In fact, we encourage it strongly. So we hope you enjoy this section and if it touches a child's interest in astronomy, our**




# LPI—FAMILY SPACE DAYS

**This is a new addition to our Starscan. It is dedicated to the LPI-Family Space Days events. Each month we will have the update of what is happening at LPI. Look here for any information in the future.**

**Children between the ages of 5 and 8 are invited to bring their families to explore space science!**

**http://www.lpi.usra.edu/education/space_days/**

## FREE EVENT!

**When the fun begins: From 10:00 a.m. to 1:00 p.m. on the third Saturday of each month.**
**Make a day of it!**

**Families are encouraged to bring lunch on sunny days and to enjoy a picnic on the Lunar and Planetary Institute's grounds.**

**Where to go:** The Lunar and Planetary Institute!

**The Institute is located at the USRA Center for Advanced Space Studies (CASS), 3600 Bay Area Boulevard, Houston, Texas 77058.** A map of the region and the LPI location is available for download(SEE THE WEBSITE LISTED ABOVE).

**Activities/What to Expect:** Hands-on activities and demonstrations will allow children and their families to explore the theme of the day for themselves. Read stories! Color pictures! Get messy with theme-based crafts and learn!

**October 6th—**Star Cities in the Sky Night Viewing! View clusters of stars and more!

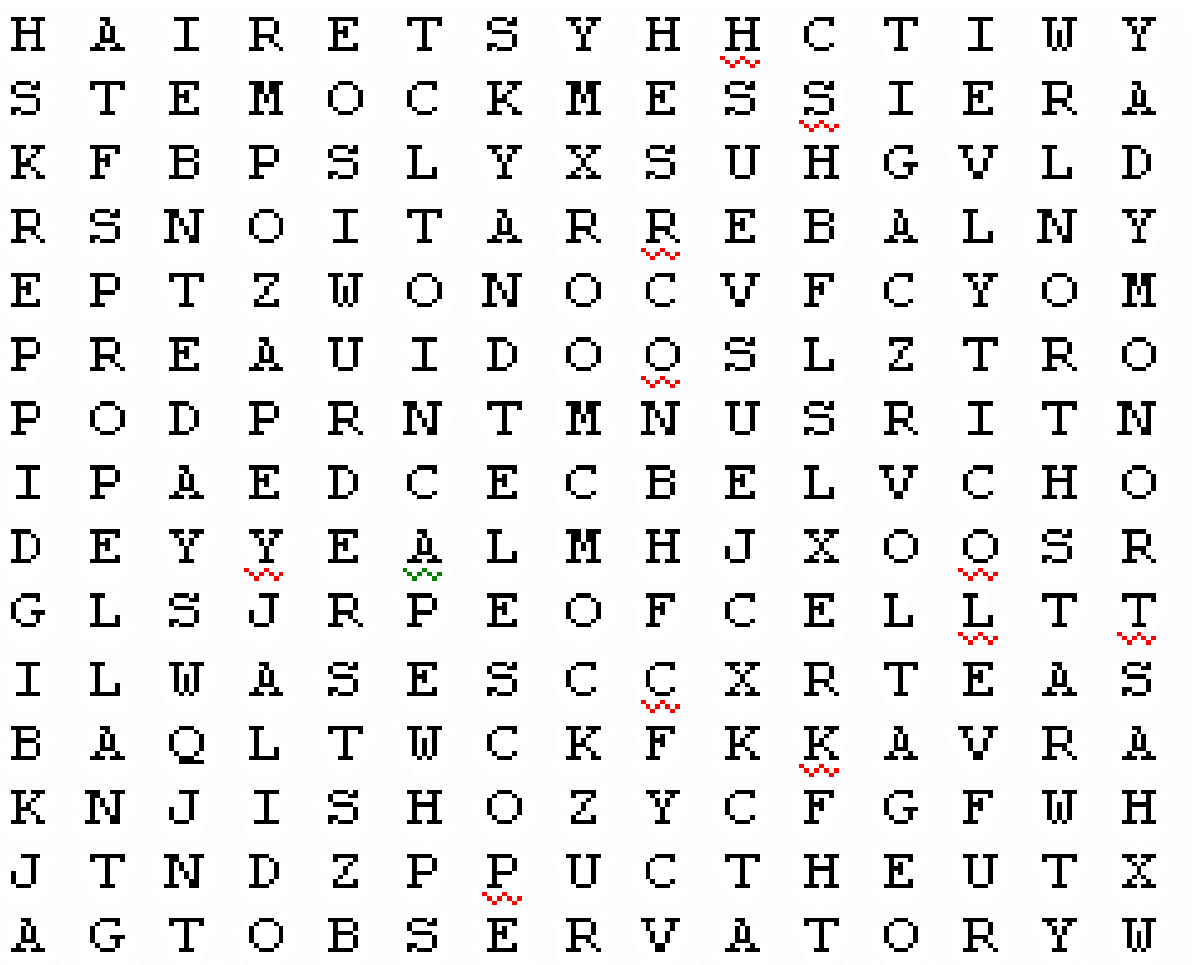
**November 10 –** The Space Shuttle! Learn all about the Space Shuttle.

**December –** No Family Space Day this month. See you again in January!

**Please note: Each child must be accompanied by a responsible parent or adult the entire time they are visiting the LPI.**

**For more information contact Katy Buckaloo, Education Assistant, 281-486-2106, or buckaloo@lpi.usra.edu.**

# WORD SEARCH



H A I R E T S Y H H C T I W Y
S T E M O C K M E S S I E R A
K F B P S L Y X S U H G V L D
R S N O I T A R R E B A L N Y
E P T Z W O N O C V F C Y O M
P R E A U I D O O S L Z T R O
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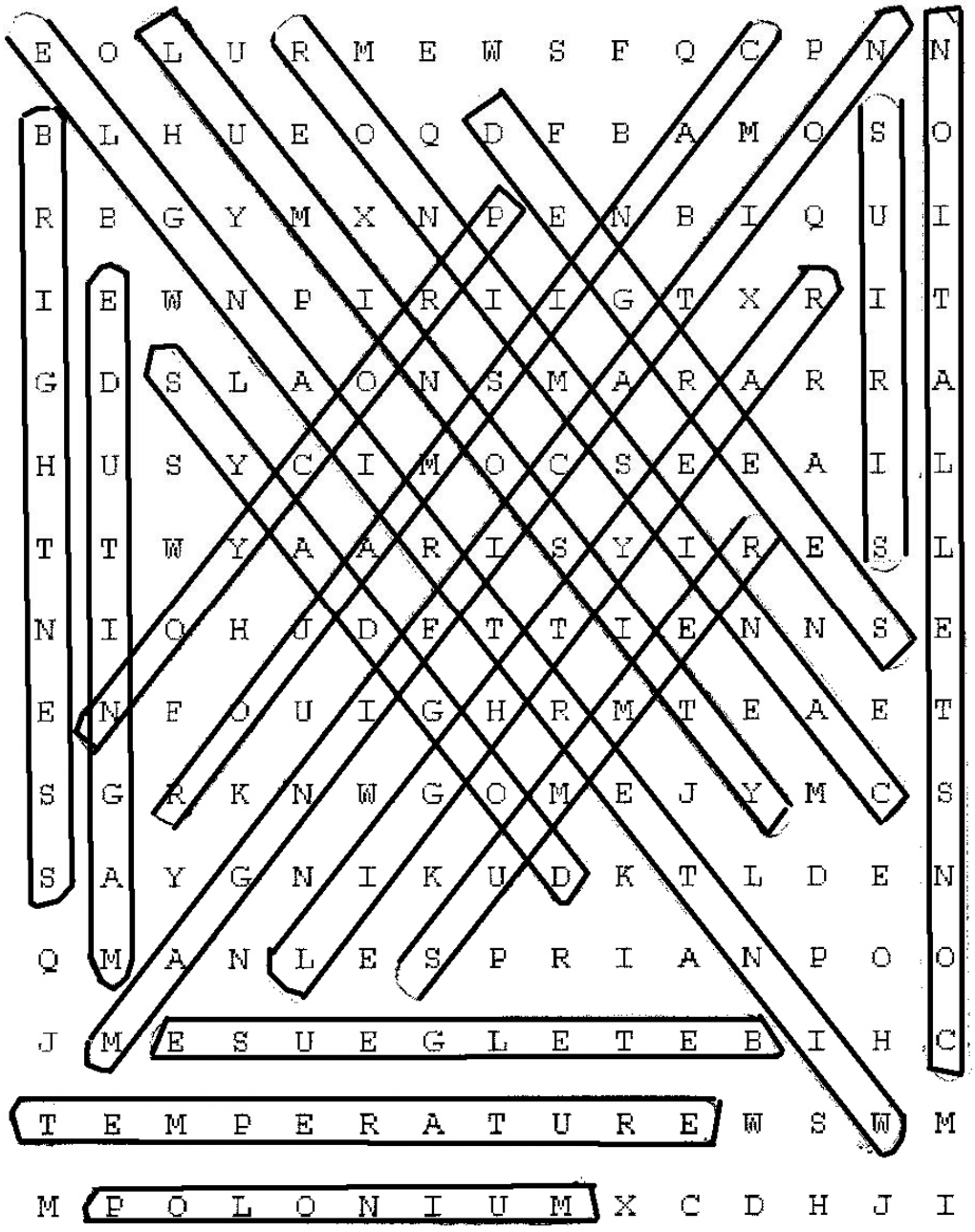
B A Q L T W C K F K K A V R A
K N J I S H O Z Y C F G F W H
J T N D Z P P U C T H E U T X
A G T O B S E R V A T O R Y W

ABERRATION
ALL CLUB MEETING
ASTRONOMY DAY
BIG DIPPER
COMETS
DEEP SKY
MESSIER
NORTH STAR
OBSERVATORY
OMEARA
PROPELLANT
SKY AND TELESCOPE
STARCLOCK
VELOCITY
VOLTAGE
WITCHCRAFT
WITCH HYSTERIA
XENON

# OCTOBER'S CROSSWORD PUZZLE


# September Word Search Ssolution



# CROSSWORD PUZZLE SOLUTIONS

**I HAVE DECIDED TO NOT HAVE A CROSSWORD PUZZLE THIS MONTH BECAUSE I AM LOOKING FOR A MORE ACCURATE CROSSWORD PUZZLE MAKER. I NOTED THAT THIS ONE DID NOT PUT THE RIGHT AMOUNT OF SQUARES AND DELETED A LETTER. WE WILL HAVE CROSSWORD PUZZLES AS SOON AS I FIND ONE THAT IS BETTER. SORRY FOR THE INCONVENIENCE.**

*THE EDITOR*

## ANSWER TO SEPTEMBER "QUESTION OF THE MONTH"

What was the highest summer temperature ever recorded in the United States?

**Answer:**

The highest temperature ever recorded in the U.S. was in California's Death Valley. The temperature reached 134 degrees. The hottest record on Earth took place in El Aisisa, Libya. That temp was 136F.

# Make Your Own Star Clock

(credited to: http://www.lhs.berkeley.edu/StarClock/starclockprintout.html)

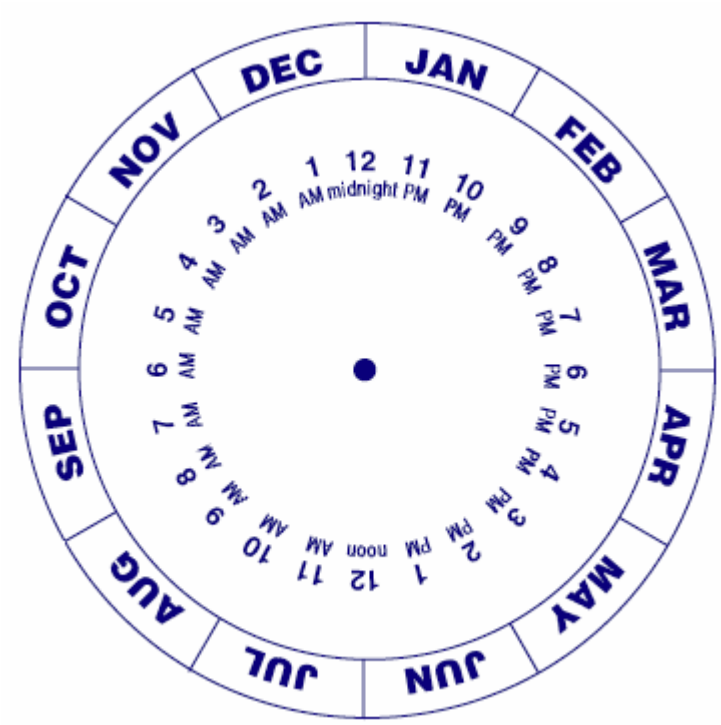
1. Print the next page and cut out the circles. If you don't have a printer, try drawing your own star clock by copying the images on the next page.
2. Cut the notch on the smaller (blue) circle.
3. Place the small circle on top of the large circle. Push a large paper faster to make a center hole through both circles and spread open the fastener on the back slde of the Star Clock or poke a hole through the circles with a pencil then thread a string or thin rubber band through the hole and knot it on both sides.

## 1 Using the Star Clock

1. Find the Big Dipper and the North Star, as shown on the face of your Star Clock.
2. Face the North Star, as shown on the front of the clock.
3. Find the current month around the outside circle of the Star Clock. Put your thumb over the current month.
4. Hold your Star Clock so the current month, marked by your thumb is AT THE TOP.
5. Holding the large disc firmly with the current month at the top, turn the smaller disc until its stars line up with those in the sky.
6. Read the time in the window.
7. If you are on Daylight Savings Time, add one hour

If you want to see an online star clock go to: http://www.lhs.berkeley.edu/starclock/

**PRINT THIS PAGE AND CUT OUT**


INSTRUCTIONS: Print only 1 single page on your printer. You can make larger by using a photocopier to enlarge. Have fun!