



## Astronomy Outreach

Don Surles

Saturday, January 6, 2007, was a special day in many ways. The weather improved from Friday's foggy & soggy to Saturday's bright sunshine and deep blue skies with record breaking high temperatures in the 70's.

Delmarva Star Gazers had agreed to present an Amateur Astronomy program to a group of young people at Mallard Lodge Saturday night. So, I packed up my truck with my old Coulter 17.5" scope, eyepieces, ladder, several cameras and went to the marsh early to do some photography and then set up for the presentation.

The sunset was beautiful from the observation tower. Beautiful reds...the edges of the few horizon clouds were illuminated like a sparkling crust...and as a special treat the setting sun illuminated the nuclear power plant off the Jersey side of the Delaware River. This was very special, the first time I have seen the power plant appear as a brilliant light in the marsh that was already darkened by sun's setting.

I was amazed at the mosquitoes that chose to perch on my truck...this was January and my truck was covered with MOSQUITOES! I also snapped a couple of shots of the Belt of Venus as nighttime crept out of the marsh to my east.

The children arrived around 6:30-7:00 PM and more Star Gazers arrived too. Tom Pomponio, Vaughn Nickerson, Leonard White, Tim Milligan, Cal Estrada, Dave Wells, and I rounded out the volunteers from our organization. We had bins, and scopes in the 4", 8", 10", and 17.5" range.

The weather cooperated very well. As night time arrived the sky cleared out the few remaining puffy sunset clouds, really cleared...no haze, no clouds, no dew. The temps dropped to a light-jacket comfortable 60F with a slight breeze.

And our old favorite winter-time astro objects showed themselves well. Of course we had to look at the Orion Nebula, Andromeda Galaxy, the Crab, the Pleiades, the Hyades, the Double Cluster in Perseus, the Owl Cluster in Cass, the open clusters in Auriga and at the feet of Gemini. Later in the session the moon and Saturn rose out of the waters of the Delaware River to the delight of the children. The children were very well behaved; there were approximately 50 of them. Each one of them was very appreciative of the opportunity to see the night sky's beautiful objects and of our equipment and knowledge.

For me this is the best of amateur astronomy. Sharing our knowledge and equipment with people under dark skies is very rewarding. Thanks to each Star Gazer and to the adult sponsors of the children who participated in the program.

Don...

## Christmas – Stargazer Style

Lyle Jones

A young single Mom (ex-military) started working in my office in early November of 2006. In December, she attended our office Christmas party that was held at my house. Several office mates asked to see my large Coulter telescope in the basement. She joined them in the basement to look at the scope.

She said that she has 10 year old daughter who has been interested in astronomy for years but has not been able to afford a scope for her. The Mom asked me where she could get a scope that was affordable and still be able to see things through it.

Steve Dexter had donated his first refractor to the Stargazers for a young person to have and we had not found anyone needing it, until now.

However, a few things were needed to complete the scope. The refractor had a 2" focuser with no eyepiece or diagonal but did have a mounting plate for a Tetrard.

I sent out an email on the Delmarva Stargazer's Yahoo group for some needed equipment.

Jean- Paul Richard and James Morgan donated cash for Tetrard, eyepiece and diagonal. James Acker donated a sturdy mount with an equatorial head and Vaughn Nickerson donated a 2 to 1¼ " reducer for the focuser. C J Wood donated a 1¼" diagonal. Consequently, we used the extra cash to upgrade the eyepiece. Tim Milligan donated an observing book and astronomical software.

Thanks to all those that helped make a young lady's Christmas, and especially Steve Dexter for the scope!!

P.S. While in the military, the young Mom looked for pieces of the Challenger Shuttle.

### The Solar System in February

Mercury ☿ will be at greatest elongation on the 7<sup>th</sup>, 7° below Venus ♀. Mars ♂ will rise just before Sol ☉ in the SE. Jupiter ♃ rises after 2AM this month. Saturn ♄ is at opposition on the 10<sup>th</sup>, so this month will give you good views. Uranus ♅ is still in Aquarius, but so is Sol ☉. You can get a glimpse just after sundown if you hunt. Neptune ♆ is in conjunction with Sol ☉ on the 8<sup>th</sup>, so you will have a hard time looking until later in the month. You can find the minor planet Pluto ♇ to the right of Scutum. (As always, you can always find Terra 🌍 by looking down). Zodiacal Light is visible in the W after sunset for 2 weeks starting on the 4<sup>th</sup>.

**How to Join the Delmarva Stargazers:** Anyone with an interest in any aspect of astronomy is welcome

NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY, STATE & ZIP \_\_\_\_\_

E-MAIL ADDRESS (If any) \_\_\_\_\_

Do you need the newsletter snail mailed to you (Y/N)? \_\_\_\_\_

Please attach a check for \$15 made payable to Delmarva Stargazers and mail to Kathy Sheldon, 20985 Fleatown Rd, Lincoln, DE 19960. Call club President Jerry Truitt at 410-885-3327 for more information.

# The Sky is Falling !

Jerry Truitt

You may have read about the home in New Jersey that was hit by a meteorite on January 5<sup>th</sup>, 2007. The space rock had traveled through two layers of singles, the plywood sheathing, the ceiling wall board, it bounced off and damaged the ceramic tile floor finally embedding itself into the wall.

The meteor was a small oblong rock weighing 377 grams (13 ounces) and crashed into a home in Freehold Township which is 50 miles south of New York City.

There are however 39 significant meteor showers each year with 4 that have peaks over 100 ZHR. You should already know that meteor showers are named for the constellation they radiate near, that is they seem to come out of a point near the constellation.

There are many smaller showers under the 100 ZHR and really you can catch a meteor streaking across the sky at any time without any association to a specific shower at all.

The ZHR is the abbreviation for Zenithal Hourly Rate and is the expected number of meteors you would see if the shower radiant was directly overhead in a light pollution free environment and clear transparent skies. These conditions can not be totally met in our area because of light pollution if for no other reason. You can assume this is just a guide to give you an estimate of what to expect from a shower.

Meteor, falling or shooting stars are all the same thing. They are debris that has entered the Earth's atmosphere. The debris is heated by ram pressure to the point it becomes incandescent and visible. Most meteors are vaporized by this heat build up long before they reach the surface of Earth.

The meteor does not become a meteorite until it reaches the surface of Earth. This of course begs the question how do you know if that strange looking rock you found on the beach is a meteorite or not? Well there four preliminary tests you can do to determine if the rock is likely to be a meteorite.

1. Parts of the rock if not all of the outer covering should be an almost shiny black. Remember the part about ram pressure as it enters Earth's atmosphere heating it until it's visible. Well the visibility or incandescence comes from the fact that this meteor may be traveling in the neighborhood of 150,000 miles per hour. The great speed as it comes into Earth's atmosphere from outer space causes ram pressure, the air molecules now suddenly in front of it are compressed... This compression results in heat build up, a lot of heat, the meteor can reach 3,000 degrees F very quickly. The envelope of heat melts the surface of the meteor. This all happens very fast, usually totaling only a few seconds at most and only the first couple of millimeters are heated on the surface and melted resulting in the black shiny surface. This by the way is ram pressure not friction causing the heat, so when someone tells you friction with the atmosphere is what causes meteors to glow you can correct them.

2. It may also have areas that look like someone pressed their thumb into it while it was still hot. This is the result of uneven heating and is referred as regmaglypts.

3. Our third test is to feel how much it weighs. Meteorites tend

to be on the heavy side, particularly compared to other rocks you'll find in the area.

4. Meteorites that reach Earth generally are high in iron content, which results in them being reactive to a magnetic source. Try this with a real magnet, hang the magnet from a string and see if it is attracted to the rock, it may even pick it up.

If your rock passed all these tests, you may want to send it to a lab to have it verified, certified and of course named, if it is found to be in fact the real deal.

You can find more tips for identifying and a list of labs that do testing at these sites:

<http://www.meteoritarticles.com/foundmeteorite.html>

<http://www4.nau.edu/meteorite/> or

<http://www4.nau.edu/meteorite/Meteorite/Book-Identification.html>

Having found a real meteor can be very profitable as they are often sliced into thin cross sections and sold at a hefty price to, well people like us, who want to own a piece of space rock.

Now meteors are the result of debris entering our Earth's atmosphere. Where is this debris coming from any way?

Most meteors are the remnants of comets that have crossed Earth's orbit path. The comet leaves a stream of debris, most of this debris is about the size of grains of sand, and a few may be as big as a baseball. This stream of debris sits there waiting for Earth transversing around the sun in its orbit at a mere 67,062 miles per hour to slam into them. Of course Earth is also spinning on it's axis at around 1,040 miles per hour at the equator, which adds to the overall velocity of the impacts, plus the stream may also be moving.

The more recent the trail of debris and the more centered the hit on the densest portion of the debris stream the greater the number of meteors we see. When the Earth is going through the edges we get a meteor shower, which is classified as 10 to 100 meteors and hour. More then 100 and you're seeing a meteor storm which may produce 1,000 or more an hour.

Not all meteor showers look the same, even for the same shower. The number of meteors seen can vary for the same shower on different years. This will depend on what pass of the comet tail Earth is going through, each time the comet completes an orbit it leaves debris we may not however hit the trail or may not hit it directly or miss some years completely.

Another thing that can dictate how a shower's meteors appear is the speed of the incoming debris. The Leonids blaze in at 71 km/s while the Geminids stroll in at a casual 35 km/s. The angle they hit the atmosphere also has an effect on the duration and length of the tail of a meteor. Earth grazing meteors often seen early in the evening will look different then ones you'll



(See *Meteorites* on page 5)

## Your 2006-2007 Officers

Office	Officer	Phone	e-mail
President	Jerry Truitt	410-885-3327	truittjs@atlanticbb.net
Vice President	Tom Pomponio	302-736-0157	pomponio@lycos.com
Secretary	Tony Codella	302-559-0297	tonytowels@yahoo.com
Treasurer	Kathy Sheldon	302-422-4695	f.a.sheldon@att.net
Editor	Pj Riley	302-738-5366	pjr127@yahoo.com
Past President	Lyle Jones	302-736-9842	lyjones@state.de.us

## A Great Big Wreck

Dr. Tony Phillips

People worry about asteroids. Being hit by a space rock can really ruin your day. But that's nothing. How would you like to be hit by a whole galaxy?

It could happen. Astronomers have long known that the Andromeda Galaxy is on a collision course with the Milky Way. In about 3 billion years, the two great star systems will crash together. Earth will be in the middle of the biggest wreck in our part of the Universe.

Astronomer John Hibbard isn't worried. "Galaxy collisions aren't so bad," he says. A typical spiral galaxy contains a hundred billion stars, yet when two such behemoths run into each other "very few stars collide. The stars are like pinpricks with lots of space between them. The chance of a direct hit, star vs. star, is very low."

Hibbard knows because he studies colliding galaxies, particularly a nearby pair called the Antennae. "The two galaxies of the Antennae system are about the same size and type as Andromeda and the Milky Way." He believes that the Antennae are giving us a preview of what's going to happen to our own galaxy.

The Antennae get their name from two vast streamers of stars that resemble the feelers on top of an insect's head. These streamers, called "tidal tails," are created by gravitational forces—one galaxy pulling stars from the other. The tails appear to be scenes of incredible violence.

But looks can be deceiving: "Actually, the tails are quiet places," says Hibbard. "They're the peaceful suburbs of the Antennae." He came to this conclusion using data from GALEX, an ultraviolet space telescope launched by NASA in 2003.

The true violence of colliding galaxies is star formation. While individual stars rarely collide, vast interstellar clouds of gas *do* smash together. These clouds collapse. Gravity pulls the infalling gas into denser knots until, finally, new stars are born. Young stars are difficult to be around. They emit intensely unpleasant radiation and tend to "go supernova."

GALEX can pinpoint hot young stars by the UV radiation they emit and, in combination with other data, measure the rate of star birth. "Surprisingly," Hibbard says, "star formation rates are low in the tidal tails, several times lower than what we experience here in the Milky Way." The merging cores of the Antennae, on the other hand, are sizzling with new stars, ready to explode.

So what should you do when *your* galaxy collides? A tip from GALEX: head for the tails.

To see more GALEX images, visit [www.galex.caltech.edu](http://www.galex.caltech.edu). Kids can read about galaxies and how a telescope can be a time machine at [www.spaceplace.nasa.gov/en/educators/galex\\_puzzles.pdf](http://www.spaceplace.nasa.gov/en/educators/galex_puzzles.pdf).

*This article was provided by the Jet Propulsion Laboratory, California Institute of Technology, under a contract with NASA.*



*This GALEX UV image of the colliding Antennae Galaxies shows areas of active star formation, which is not in the tidal tails as one might expect.*



I've had several opportunities to see Comet McNaught, though none as nice as some of the spectacular photos I've seen printed or on the web. Here's a photo of mine from last week on the 18<sup>th</sup>: while not quite as bright as Venus, the comet easily shone through clouds and haze over Auckland, New Zealand. Last night, the tail was much longer, 10-15 degrees, but clouds really interfered with the view. Hoping for much better views and more photos before the show is over! -Doug Miller

*(Jerry from page 1)*

to hold No Frills in October this year. We will open Wednesday night the 10<sup>th</sup> and go until Sunday the 14<sup>th</sup>. Keith has confirmed both these dates so we're ready to roll.

I don't know how many of you got to see the spectacular comet McNaught. I managed to see it coming home down I-95 approaching Rt. 896. It was amazing, I thought for sure it was a jet trail, but I soon noticed it didn't move like the many jets in the sky. I really wanted to take a picture but sanity took over and I decided not to try at 55 (OK 70) mph cruising down I-95.

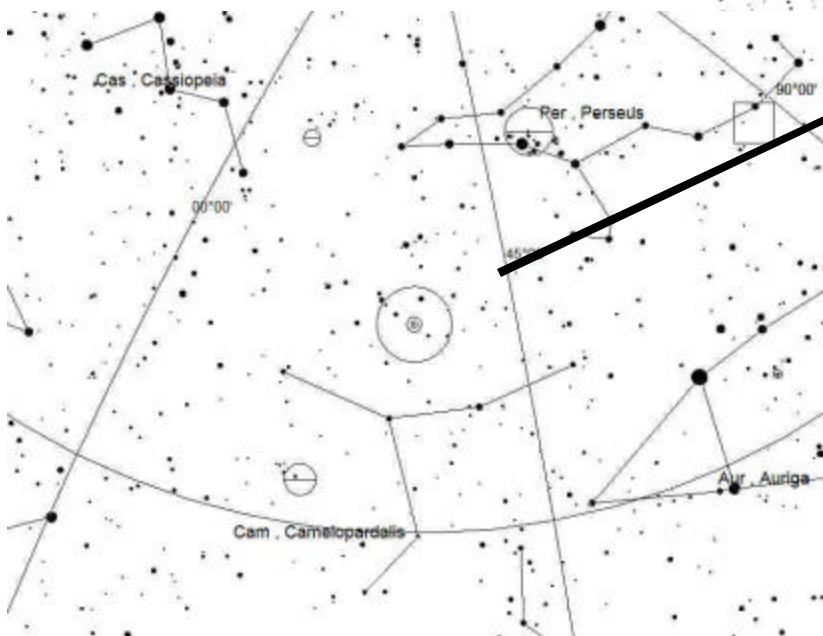
I've seen many pictures of the Southern view and I have to admit to being a bit jealous. It looks like they are getting a real treat. Doug Miller sent a note from New Zealand commenting he's got to see it several times. Look for his picture elsewhere in the newsletter.

It just goes to show you never know what surprises will come our way. If you get a chance get out and observe. If you do send Pj a note about what you saw and who you were with while observing. Until our meeting Clear Skies.

## Pj's Pick—Kemble's Cascade

Pj Riley

Looking for a nice binocular object to find? Then look for Kemble's Cascade in Camelopardalis. Located near NGC1502, an open cluster. It is a string of ~ 9 mag. stars in a relatively straight line. Use these charts to help find this gem.



First found by Lucian Kemble in 1980 from Alberta Canada using 7 X 35 binoculars, it was put in the 1987 edition of Uranometria 2000.0

(*Meteorites from page 3*)

see later in the night.

Predictions are also just that, there are many factors that can change the number of meteors we see. The dust stream may be more or less denser than we thought, an old trail of dust might still be present and not in the computations used to predict the number of meteors, creating more than predicted.

The Geminids which we saw in mid-December 2006 come from an object called 3200 [Phaethon](#). This object is now thought to be an extinct comet. The Geminids are one of the best annual showers and appears to get better each year. It is also the newest, they started to appear just 150 years ago. I witnessed a nice bright slow moving meteor from this shower last year. This is a shower that frequently displays a fire ball or two. A fire ball is a meteor about the size of a baseball which will actually display flames as it enters the atmosphere.

This new found shower resulted in astronomers searching for a comet to relate to the Geminids. It wasn't until we started launching satellites into space that we pegged an object to the shower. The infrared IRAS satellite found what was first thought to be a debris spewing asteroid. Scientist now think this Near Earth object which grazes as near as eight moons to Earth and also goes inside the orbit of Mercury getting very close to the Sun, is really a cooked comet. This short period object goes from the asteroid belt every year and a half then plunges back to graze sun, spewing material all the way.

The meteors from the Geminids are often yellowish in color and slow moving at 35 km/s (22 mps) with a peak output of 120 meteors per hour at the peak, which was December 14 in 2006. You will start to see them on December 7 and they'll continue to appear until the 17 of the month. This is because the debris stream of comets are spread out, the peak or ZHR is when we are going through the densest part of the stream.

For even more information on meteors and charts on 2007 visit <http://www.namnmeteors.org>, this is the North American Meteor Network's home page. Hope you take time out to watch the November Leonids or the December Geminids.

Now there are a lot of other things up in the sky that shine brightly and move. One particular bright streak of light you may catch is called a Iridium Flare. This is the Sun reflecting off the solar panels of a defunct cell phone communication satellite. These and many other satellites can be tracked at <http://www.heavens-above.com/>.

## Magazine Subscriptions

As a paid member of DMSG, you can sign up -or- renew your S&T or Astronomy magazines through the club for a discount over private rate. S&T, reg. \$42.95, is \$32.95 thru DMSG, Astronomy, reg. \$44, is \$34 thru DMSG. See Tony Codella for details.

# Shallow Sky Sorties

Jim Tomney

Those of you who subscribe to the Yahoo group are aware of Don's challenge to rekindle the passion that most of us have for this crazy hobby. To one degree or another we all succumb to life's demands which can reduce our astronomy activity to visiting APOD or skimming the latest *Astronomy*. And then there's the issue of venues – many suburban members face the combination of a limiting skyline and abundant sky glow that impart a sense of futility.

I'm not quite ready to make my eyepiece time a biannual event at Tuckahoe. I've found nothing else that can touch my soul in the same way as perusing the night sky. So with a New Year comes a new resolution of changing my strategy a bit. Go with shorter, simpler "missions" when skies are clear yet the flesh is somewhat hesitant or the spirit a bit defeatist. If the 10" is too much effort then go with the 60mm refractor (or even binoculars). Keep a simple star atlas at the ready rather than sitting down at the computer to crank out charts.

**Sortie:** (noun) Etymology: French, from sortir to go out

1: a sudden issuing of troops from a defensive position against the enemy

2: one mission or attack by a single plane

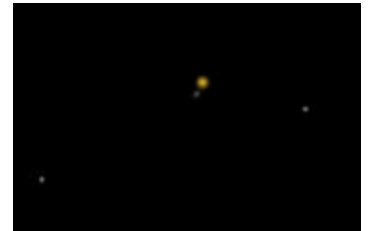
3: Foray or raid

Purpose – from attempting to accurately time the transit of a Jovian feature to bagging another faint fuzzy from the Herschel list, purpose serves as catalyst for getting out there. For now a suitable project that captures my imagination is revisiting the [AL's Urban List](#) and assessing it. A few years ago at a yard sale to raise funds for my sons' Scout troop there was a 60mm refractor for sale. Not a typical Tasco fiasco, but one with a surprisingly nice GEM. So when there were no takers I acquired it for \$15 (the hard part was convincing my better half that I needed yet another, smaller scope to add to the stable). I upgraded the two eyepieces and tacked on a red-spot finder to make it more functional, and it resides covered on the porch, ready to go at a moment's notice. So my quest is assessing just how realistic the Urban list is for such a modest instrument in limiting magnitude 4 skies? What may have been overlooked from the list – and what should have never made the cut?

---

Session Notes: Towson, MD Jan. 9, 2007 00:30 UT. Clear skies, ~45° with NW wind gusting to about 15 mph. Seeing 2/5, transparency 4/5. 60mm refractor, 20mm and 10mm eyepieces.

**h Cassiopeia.** Rating: 6 [3-2-0-1]. This double is easy to locate near a Cas and is fairly obvious as a double at 80x. The secondary is a good deal fainter (7.5) and colorless compared to the significantly brighter primary (3.4) which definitely sports a yellowish tone. PA guesstimate was 330°, actual is 307°. Sparse field stars accompany it. This primary is apparently pretty similar to Sol and so offers you the perspective of what our own star would look like ~19 light years away.



**WZ Cassiopeia.** Rating 5 [2-2-0-1]. Not a part of the Urban list, I remember stumbling across this fine double with my 6" on the way to NGC 7900. The star hop is a little harder but lies close to b Cas. The primary is a fine example of a carbon star, and even in the small scope the reddish color can be clearly discerned like an ember fighting for its life. The comes is easily split in this almost 1' separation; the field is a little more lively than h Cas. These two are a little closer in magnitude at 7.5 and 8.0 but the beautiful contrasting blue is unfortunately lost at this aperture.

---

I'll blog the observations (<http://shallowskysorties.blogspot.com>) and hope you'll drop by to add your own impressions about what makes a good "shallow sky" candidate. Until next month – Carpe Noctem ["Seize the Night"]!

## The Delmarva Stargazers Announces a Writing Contest.

The DMSG will raffle away astronomy gifts to members who submit articles to the Star Gazer News.

How to enter:

- 1 Open to DMSG members.
- 2 Members may submit original articles at least 500 words (1/2 page) for publication in the Star Gazer News.
- 3 Articles **must** be authored by the member.
- 4 Pictures can be included, but they do not count towards word count (1 picture<sup>1</sup> 1000 words).
- 5 Must be astronomy related. Each article = one chance in the raffle. The drawing will be made at the star parties based on the previous 6 issues – need not attend to win (but it would be nice to see you there). *The editor of the Star Gazer News qualifies articles submitted.*



Tuckahoe State Park MD

**STARS**

- <1
- 1.5
- 2
- 2.5
- 3
- 3.5
- 4
- 4.5
- >5

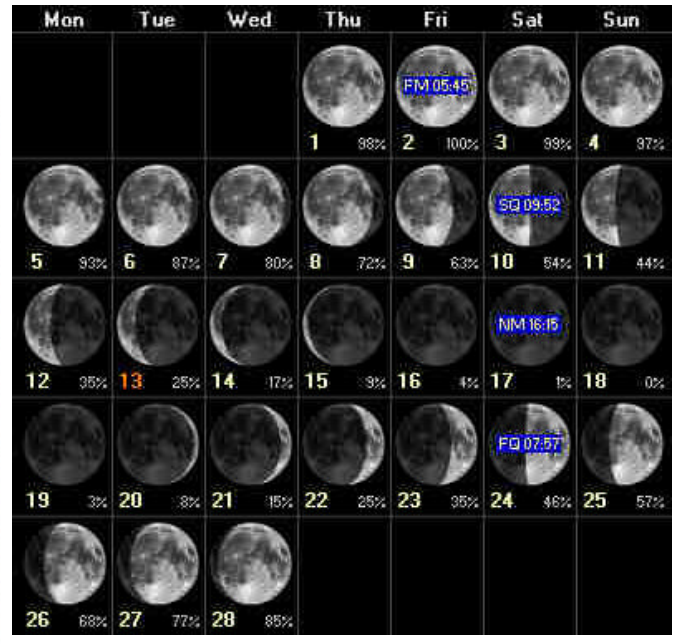
**SYMBOLS**

- Multiple star
- Variable star
- ☉ Comet
- ☼ Galaxy
- ☼ Bright nebula
- ☼ Quasar
- ☼ Dark nebula
- ☼ Globular cluster
- ☼ Open cluster
- ☼ Planetary nebula
- ☼ Radio source
- ☼ X-ray source
- ☼ Other object

Local Time: 22:00:00 16-Feb-2007  
 UTC: 17:00:00 16-Feb-2007  
 Sidereal Time: 21:41:29  
 Location: 38° 58' 0" N 75° 56' 0" W  
 RA: 21h41m30s Dec: +38° 57' Field: 182.0°  
 Julian Day: 2454148.2083

**Sun and Moon Data for February 2007**  
 Tuckahoe MD  
 38.97°N 75.93°W 5hrW  
 Standard Time Civil Twilight

Date	Twilight	Rise	Sun Transit	Set	Twilight	Rise	Moon Transit	Set	%
2/1/2007	6:42a	7:10a	12:17p	5:25p	5:53p	4:53p	*****	7:05a	100
2/2/2007	6:41a	7:09a	12:17p	5:26p	5:54p	5:59p	12:20a	7:35a	100
2/3/2007	6:41a	7:09a	12:18p	5:27p	5:55p	7:02p	1:08a	8:01a	98
2/4/2007	6:40a	7:08a	12:18p	5:28p	5:56p	8:03p	1:48a	8:24a	94
2/5/2007	6:39a	7:07a	12:18p	5:29p	5:57p	9:02p	2:29a	8:44a	89
2/6/2007	6:38a	7:06a	12:18p	5:30p	5:58p	10:01p	3:08a	9:04a	82
2/7/2007	6:37a	7:05a	12:18p	5:32p	5:59p	11:00p	3:47a	9:24a	75
2/8/2007	6:36a	7:04a	12:18p	5:33p	6:01p	*****	4:27a	9:46a	66
2/9/2007	6:35a	7:02a	12:18p	5:34p	6:02p	12:01a	5:10a	10:12a	57
2/10/2007	6:34a	7:01a	12:18p	5:35p	6:03p	1:03a	5:55a	10:42a	47
2/11/2007	6:33a	7:00a	12:18p	5:36p	6:04p	2:07a	6:45a	11:19a	37
2/12/2007	6:32a	6:59a	12:18p	5:37p	6:05p	3:10a	7:39a	12:05p	28
2/13/2007	6:30a	6:58a	12:18p	5:39p	6:06p	4:10a	8:35a	1:01p	19
2/14/2007	6:29a	6:57a	12:18p	5:40p	6:07p	5:04a	9:34a	2:09p	11
2/15/2007	6:28a	6:55a	12:18p	5:41p	6:08p	5:50a	10:32a	3:21p	5
2/16/2007	6:27a	6:54a	12:18p	5:42p	6:09p	6:28a	11:29a	4:38p	1
2/17/2007	6:26a	6:53a	12:18p	5:43p	6:10p	7:00a	12:22p	5:55p	0
2/18/2007	6:25a	6:52a	12:18p	5:44p	6:11p	7:29a	1:14p	7:11p	2
2/19/2007	6:23a	6:50a	12:18p	5:45p	6:12p	7:55a	2:04p	8:26p	6
2/20/2007	6:22a	6:49a	12:17p	5:46p	6:13p	8:21a	2:55p	9:41p	13
2/21/2007	6:21a	6:48a	12:17p	5:47p	6:15p	8:48a	3:46p	10:57p	22
2/22/2007	6:19a	6:46a	12:17p	5:49p	6:16p	9:19a	4:40p	*****	32
2/23/2007	6:18a	6:45a	12:17p	5:50p	6:17p	9:55a	5:36p	12:13a	43
2/24/2007	6:17a	6:44a	12:17p	5:51p	6:18p	10:39a	6:35p	1:27a	54
2/25/2007	6:15a	6:42a	12:17p	5:52p	6:19p	11:31a	7:34p	2:36a	65
2/26/2007	6:14a	6:41a	12:17p	5:53p	6:20p	12:31p	8:31p	3:36a	75
2/27/2007	6:13a	6:40a	12:16p	5:54p	6:21p	1:36p	9:26p	4:25a	83
2/28/2007	6:11a	6:38a	12:16p	5:55p	6:22p	2:43p	10:16p	5:06a	90



## Ancient Wizardry

Doug Miller

All the [notable celestial events predicted for 2007](#), highlighted in last month's column, are the result of modern computer computation. Predictions far beyond any practical standard of accuracy can be made online using Newton's laws, [astronomical algorithms](#) and a bit of electrical power. The results [appear like magic on the screen](#), almost instantly and without a sound, save for a mouse-click. But two thousand years before the invention of the Web, the Greeks had a pretty amazing device that could predict most all of the planetary and lunar events described in [last month's column](#).

Discovered by Greek sponge divers in 1901, artifacts recovered from [a Roman shipwreck](#) included a lump of corroded bronze and wood. Gears were discovered inside its cracked mass, but not until 70 years later was this artifact interpreted as an [astronomical computer](#). [Recent studies](#) have far superseded past work. [X-ray tomography](#) has revealed a gears and workmanship like that inside a wristwatch. High-tech surface image techniques have [allowed scientists to read many more inscribed characters](#) on the exterior, apparently amounting to the user's manual.

A virtual reconstruction [has recently been published in the scientific literature](#) (a replica has been made for a London museum), and the original resides on display in [Athens](#). Named after [the island near its discovery](#), the [Antikythera Mechanism](#), is an incredible anomaly. No earlier geared mechanism is known, and nothing approaching its technology appeared for the next thousand years. The virtual renderings are astonishing and have to be seen to be believed.

[About the size of a shoebox](#), the front had [two concentric dials](#), one representing the Zodiac, the other the days of the year. By turning a knob, tiny balls showing the position of the Sun and Moon and pointers for the five known planets all moved in accurate relative motion. Two spiral dials adorned the backside of the box. The top dial showed the [Callippic Cycle](#) (four Metonic cycles less one day), and the bottom dial represented the [Saros cycle of eclipses](#). Inside, over 30 gears drove the solar system through its orbital motions. By far the [cleverest aspect of the mechanism](#) appears in two wheels, one atop another engaged by a slot with a pin on the lower wheel. Since they are not centered, the top wheel moves faster or slower depending on the position of the pin. Mechanically, this [pin-and-slot arrangement](#) mimicked changes in speed as the Moon orbits the Earth elliptically, precisely as described by the [famous Greek astronomer Hipparchus](#).

Based on geographic location and other shipwreck artifacts, the origin of the mechanism can be determined with some certainty: vases from the [trading port of Rhodes](#) were part of the cargo. Rhodes was the center of astronomical science in the first and second centuries BC, and [Hipparchus studied on Rhodes](#) until his death about 120 BC. Recovered coins date the shipwreck to shortly after 85 BC, and given the apparent novelty and sophistication pin-in-slot mechanism, it is very possible that this device may have been inspired or even used by Hipparchus himself.

The Antikythera Mechanism is an [analog computer](#), something that has all but disappeared in the digital age of the Internet and web. A [plansisphere](#) or star wheel is an analog astronomical computer, and a [slide rule](#) is an analog numerical calculator, but neither is anywhere as sophisticated as the Antikythera Mechanism. As impressive as it seems today, its power must have seemed astonishing to people long ago. Perhaps rather than designed for mere computation, as the Greek's equivalent of the [World Wide Web](#), the Mechanism was itself a representation of the [beauty of the heavens](#).

*Moondark is written by Doug Miller, published at the [Moondark web site](#), and printed in the [Delmarva Star Gazers' Star Gazer News](#). This document was last revised on 1 January 2007. Text and images copyright © 2007 by Douglas C. Miller, All Rights Reserved. This material may not be reproduced in any form without prior permission.*



*Will any of these elements from our present-day digital devices survive even the next 100 years?*