

# The ASTERISM

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## Supporting the 'People of Science'

by Bonnie B. Witzgall

Professor George Darwin, son of Charles Darwin, wrote a book on tides in 1898 and developed a method for predicting high and low tides. Obviously, he was an educated person, interested in the natural world and wanted this information to reach the masses. His daughter, Margaret Keynes (1845-1923) wrote a letter describing her father. In her narrative, she explained her father, "...lived in a genteel era when people like him were known as 'men of science,' and not 'scientists', a new and mongrel word he abhorred and never used."

Oh, really? It's so odd to learn the term 'scientist' was once considered a critical remark and not accepted as an honored description. I wondered why? Why would 'men of science' (or 'people of science' to be gender neutral) feel insulted by the label of 'scientist'? Were there that many scientific researchers who fit the description but did nothing? Maybe they did not share their findings or not practice the scientific method, yet called themselves 'scientists'? Perhaps the 'real people of science' could not rise above negative inference of that old-time inferior label.

Back then, perhaps the term 'scientist' was the equivalent to today's four-letter "Nerd" word, used to describe techno-geeks, scholarly students and people dedicated to science. Actually, I have no problem with that moniker; in fact, some of my best friends are N--ds and proudly accept the title! We are not bothered by the stigma of the old stodgy definition nor the bullies who tormented us in school for being N--dy. Moreover, for the progressive sake of civilization, the world needs more dedicated N--ds!

The English language is a living, moving entity, which flows like Professor

Darwin's tide tables. Countless words and catch phrases come and go in and out of style and definitions become distorted and misused. Then as now, ignorant masses seem to hang on to insulting 'buzz' words. They think Roget's Thesaurus is a French dinosaur. All those uncouth have no other way of describing or comprehending the scientific achievers in the world. Yet most 'people of science' are willing to teach these rude insulters. Go figure.

AAI is an organization filled with many good mentors, enthusiastic 'people of science' and gratified N--ds. They are content to have found an enlightened haven where it's safe and acceptable to rise above the uninformed. I'm proud to be associated with current-day scientists and especially fellow astronomical N--ds. Excelsior!  $\Omega$

[Editor's Note: Nerds Rule!]

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### Dome Duty Schedule

Sept. 16	Team C
Sept. 23	Team D
Sept. 30	Team E
Oct. 7	Team A
Oct. 14	Team B
Oct. 21	Team C
Oct. 28	Team D

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### Club Email Addresses:

[editor@asterism.org](mailto:editor@asterism.org)

*Editor of The Asterism  
membership@asterism.org*

*AAI Membership Chair  
trustees@asterism.org*

*All three Trustees of AAI  
exec@asterism.org*

*Executive Committee  
ray@asterism.org*

*Ray Shapp for website matters*

Monthly Meeting  
Friday, September 16<sup>th</sup>  
at 8:00 PM

in the Main Lecture Hall

This month our speaker will be

**Dr. Rusian Belikov**

*Professor of Physics  
and Astronomy*

*Princeton University*

*whose topic will be*

"Finding Extra-Solar  
Earths"

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### Membership Dues

*Regular Membership: \$21  
Sustaining Membership: \$31  
Sponsoring Membership: \$46  
Family Membership: \$5*

*Sky & Telescope subscription:  
\$32.95*

*Astronomy subscription:  
\$29.00*

*First Time Application Fee: \$3*

*Dues can be paid to the Club  
Treasurer or Membership  
Chairperson at the Observatory.*

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The  ASTERISM

can be reached at  
[editor@asterism.org](mailto:editor@asterism.org)

# THEATER IN THE SKY

by Ron Ruemmler

October 2005 brings the Greatest Pumpkin to New Jersey! Big, orange Mars closes its year-long brightening act with a spectacular finale just one night before Halloween. It will be thirteen years before the Red Planet comes closer than this month's 43,137,342 miles.

Two years ago Mars was at its 60,000 year super-minimum distance from the earth, but was only 34° above the southern horizon at its highest an hour after midnight. Most folks were in bed before it cleared the trees. This time Mars reaches a full 66° up by midnight and will be high in the southeast long before that.

At magnitude -2.3, Mars tops out at just below Jupiter's maximum of -2.5, but since the Giant Planet is lost behind the sun this month, it can offer no competition. Venus is still at its usual minus 4 magnitude, but it sets about an hour after the end of evening twilight. Still, this is our first chance in over a year to see our two nearest planetary neighbors in the evening at the same time.

Mercury is technically an evening object all month, but its astronomical geometry is truly horrible. That's because the Speedy Planet is midway between two excellent morning appearances. An interesting triple challenge happens just after sunset on the 4<sup>th</sup>. Mercury, Jupiter, and the very thin crescent moon form a tight little triangle very low in the west just 13° from the sun. Binoculars may be needed for all three objects.

Saturn is worth a mention since it rises before midnight after we get rid of Daylight Saving Time. The Ringed Planet looks a bit different in a telescope than it did last year. Then the rings were tilted so far that the north pole was hidden from our view. The overall outline was a simple ellipse. This year the rings have flattened out a bit and the planet is starting to bulge out from them. In 2009 the rings will become vanishingly thin.

Both outer gas giants are excellently placed for primetime telescopic viewing. Neptune is at its highest due south around 9 PM with the same for Uranus about two hours later.

The weirdly wonderful path of the moon this year reaches its climax this month with both the highest and lowest moons of the year. After rising in the early afternoon of the 9<sup>th</sup>, the moon sets just 8 hours and 30 minutes later, just clearing the southern horizon around dinner time. By contrast, the northernmost moon of the year rises in the early evening of the 21<sup>st</sup> and doesn't set until the afternoon of the following day, almost 16½ hours later! Unfortunately, if you want to see the highest moon of the year you will have to arise well before sunrise.

Midway between these extremes are the "nodes" where the moon crosses the plane of the earth's orbit. This month everything lines up so well at the nodes that there are two eclipses, but neither one is visible from New Jersey. Ω

## OCTOBER SKY CALENDAR

3 MON 6:27 AM New Moon; annular solar eclipse  
visible from Spain and Africa  
3 MON 6:36 PM Sunset; Ramadan and Rosh Hashanah  
(Jewish year 5766) begins  
4 TUE 6:50 PM Mercury just below Jupiter to right of  
very thin crescent Moon  
6 THU 7:30 PM Crescent Moon lower right of Venus  
9 SUN 1:51 PM Southernmost moonrise of the year  
9 SUN 6:06 PM Southernmost high moon of the year  
9 SUN 10:21 PM Southernmost moonset of the year  
10 MON 3:01 PM First Quarter Moon  
16 SUN 7:30 PM Venus passes above Antares

17 MON 8:13 AM Full Moon; partial lunar eclipse visible  
from Pacific Ocean  
18 TUE 9:30 PM Moon upper right of Mars  
21 FRI 8:38 PM Northernmost moonrise of the year  
22 SAT 4:48 PM Northernmost high moon of the year  
22 SAT 12:59 PM Northernmost moonset of the year  
24 MON 6:00 AM Moon just below Castor and Pollux  
24 MON 9:17 PM Last Quarter Moon  
25 TUE 6:00 AM Moon upper left of Saturn  
29 SAT 10:00 PM Mars nearest to Earth  
30 SUN 2:00 AM End of Daylight Saving Time; turn  
clocks back one hour

## Future Monthly Meeting Topics

October 21, 2005

### “Future Large Optical Solar Telescopes”

**Dr. Dale Gary**, Professor of Physics NJIT and director of the Owens Valley Solar Array radio telescope near Big Pine, CA

November 18, 2005

### “Antique Telescope Restoration and Repair”

**Christopher Ray** is a member of The Antique Scope Society and a restorer. He will be lecturing on some of the scopes that he has worked on.

December 16, 2005

### “The Tuthill Scope”

**Clif Ashcraft** is a longtime AAI member who will discuss the restorations being made to the 20” Tuthill trailer scope.

### January 20, 2006 “Fire and Ice: Upcoming NASA Missions”

**Kevin Conod** is Manager of the Newark Museum's Dreyfuss Planetarium and author of The Star-Ledger's weekly astronomy column.

February 17, 2006

### “Light”

**Dr. Ivan Strom** is a professor of Astronomy at Union County College and a member of A.A.I. He will talk about how light is made and how we learn about astronomy via spectra, and will show images of various objects in different spectral regions.

March 17, 2006

### “Stellar duets: How companions shape the life and evolution of stars.”

**Dr. Orsola DeMarco** received her PhD in Astrophysics from University College London in 1997 and is currently with the American Museum of Natural History

April 21, 2006

### “Albert “Doc” Ingalls”

**Ms. Trudy Bell** is an author of books on Astronomy and the Sun. Her lecture pertains to Albert Ingalls. He constructed and donated one of the first telescopes in the Sperry Observatory.

May 19, 2006

## Annual Members' Meeting

# ASTRONOMICAL TIME SCALES

by Lew Thomas

As of this writing the most uniform and, as far as we know, unvarying, time unit is the *système internationale* (SI) second. It is equal to 9,192,631,770 cycles of radiation of the ground state hyperfine transition of an atom of Cesium-133. According to the General Theory of Relativity, clocks advancing by SI seconds in one reference system may not advance at the same rate in another. Accordingly corrections must be made for terrestrial effects for earth-based ephemerides and for other gravitational and motion effects for other objects in the solar system and elsewhere. Nonetheless, the SI second may be used as the fundamental time scale in all time measuring systems.

International Atomic Time (TAI) is based upon the SI and is the most precisely determined time we have available at present. Terrestrial Time (TT) is now used in the *Astronomical Almanac* to compare with observations from the earth's surface.. It uses the SI second and has the following epoch offset compared to TAI

$$TT = TAI + 32184$$

The only purpose for this strange offset is to make time based upon previous used standards (such as Ephemeris Time, based upon earth revolution) continuous.

There are time scales used which are based upon the earth's variable rotation. The most common among these is UT1, commonly called Universal Time. It is based on measurements made at the Greenwich meridian (longitude 0°) of the hour angle of the vernal equinox. This is called Apparent Sidereal Time. It takes into account the effects of precession and nutation which are caused by lunar gravity. From the apparent sidereal time at Greenwich, the universal time (UT1) is calculated.

UT1 was so defined up to and including the *Astronomical Almanac* of 2005. Thereafter a new but not discontinuous system will be used. It is based upon two coordinate systems. One is the Celestial Ephemeris Origin (CEO) and the other is Terrestrial Ephemeris Origin (TEO). The CEO does not rotate with the earth and is

fixed by precessional and nutational theory. The TEO rotates with the varying rate of the earth. The angle between the two is called  $\theta$ , which is a direct measure of the earth's rotation, and will be used after 2005.

The difference between TT and UT1 is defined as

$$\Delta T = TT - UT1$$

$\Delta T$  is variable and cannot be precisely determined until after the fact since the earth's rotation is not precisely predictable. However, it is often extrapolated for short periods of time and for 2005 it is about 66 seconds.

The world system of civil time is called Coordinated Universal Time (UTC). It is a hybrid system which uses the SI second as its base unit. It is kept within 0.9 second of UT1 by adding a “leap second” at the end of June or December when necessary. The difference between UT1 and UTC is

$$\Delta UT1 = UT1 - UTC$$

which is always less than 1 SI second. It is given by code on shortwave radio time signal station WWV.

Also

$$\Delta AT = TAI - UTC$$

A more detailed description of time scale is given in the *Astronomical Almanac* for 2005 in the L section and also in the *Explanatory Supplement to the Astronomical Almanac*, 1992, University Science Books.

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[Editor's note: If you have access to a shortwave radio, WWV, located in Ft Collins, CO can be heard 24/7 at 2500., 5000., 10 000., 15 000. and 20 000. kHz. Sister station WWVH in Hawaii can be heard on all but the last of those frequencies. WWVB operates at 60 kHz and is used by most clocks that correct for atomic time. By telephone, time signals can be received by phoning 1 (303) 499-7111. Also, the atomic time (though not as accurate due to network lag and latency) can be found at <http://www.time.gov>.]

# ***Stewart's Skybox***

by Stewart Meyers

Welcome to the first installment of Stewart's Skybox, a column where space science will be discussed with a touch of wit and pop culture references.

This summer, the big news was the *Deep Impact* mission in which a probe slammed into the nucleus of Comet Tempel 1 in an attempt to blast out a crater so the separate flyby probe could see inside. To understand why the mission was of such great interest, a brief review of the comet nucleus is in order.

## **Comets' Anatomy**

The nucleus of a comet is a city-sized object composed of water ice, some frozen gases (ammonia, carbon dioxide, etc.), dust, and other substances (mostly thought to be carbon compounds). When a comet nears the sun, the ices sublimate into gases and escape the comet, taking some of the dust with them, forming the coma and tail.

Spacecraft images of the nuclei of Comet Halley, Comet Borrelly, and Comet Wild 2 have shown us that they are as dark as copier toner, unlike the snowy comet nucleus in the opening credits of *Star Trek: Deep Space 9*. The reason for this is simple. As a comet loses its ices, some of the darker components are left behind and form a crust on the nucleus, sort of like how a pile of plowed snow gets dark and crusty as the snow melts. Over time, the crust is thought to become so thick that the comet ceases to be active and then resembles an asteroid.

## **Deep Impact (Not the Film)**

Of course, all this needed to be proven. But Earth-based observations and spacecraft images can do only so much. To make further progress, more direct methods are needed.

In 2004, the *Stardust* mission zipped past Comet Wild 2 and captured dust samples from the tail. A capsule containing the samples will return to Earth in January 2006 (hopefully intact). And November of 2014 will see the ESA's *Rosetta* mission attempt to land a probe on a comet nucleus to study it up close. But both missions only scratch the surface. *Deep Impact* would literally delve deeper into the nucleus.

As they would say on *Law & Order*, the *Deep Impact* vehicle consisted of two separate but equally important parts:

The impactor that would actually hit the comet and the flyby probe that would take images and measurements of the debris cloud as well as any resulting crater. The flyby craft carries two cameras (one for high resolution images and one for lower resolution work) and an infrared spectrometer to study the composition of the debris cloud. The impactor had a camera for guidance as well as closeups of the comet surface prior to impact and thrusters to keep it on target. At the heart of the impactor was a short 248-pound copper cone. Its sole function was to add mass to the impactor so that the explosion at impact would be bigger due to an increase in the probe's kinetic energy. Copper was chosen because copper is not a constituent of comets and would be easy to subtract from measurements of the debris cloud.

Launched on January 12, 2005, the *Deep Impact* mission made its way to Comet Tempel 1. The cruise was uneventful except for a minor focusing glitch with the high resolution imager. However, this was not serious and image processing could correct it.

The next bit of action took place late on July 2<sup>nd</sup>, when the impactor separated from the flyby craft and started to head towards the path of the comet. The camera on the probe was activated and the guidance system took control, correcting the impactor's aim from what would have been a miss to a definite hit.

The night of July 3<sup>rd</sup>, I fired up the computer and watched the NASA TV webcast coverage. Considering past NASA webcasts, it was miraculous that there were no problems this time. The images from the impactor were coming in. At first, they shown an irregularly shaped gray blur. But, as the probe got nearer, the image improved and features started to appear. The nucleus was heavily cratered. Other rough features were seen in the seconds prior to impact.

The impact was on target and on schedule at 1:52 AM (Eastern Time). Things were a bit tense at JPL as the scientists waited for confirmation of the impact. Then, a picture from the flyby craft appeared. The probe did indeed hit the comet and it produced an enormous debris cloud. After some more pictures, NASA TV concluded its coverage.

## **Success? Yes and No**

After the dust literally settled, scientists started to analyze all the information from the flyby probe as well as various space and ground based telescopes.

As for how big a crater the impactor left, that may never be known. Seems the debris cloud interfered with attempts to image the nucleus after the impact.

A bigger surprise was that the gas production of the comet increased only slightly then went back to earlier levels. Currently, this is thought to be due to the surface crust being thicker than expected, so the manmade crater did not expose much buried ice.

One discovery from this mission was the texture of the comet's surface. Many science fiction authors, including Sir Arthur C. Clarke, thought that the carbon compounds on the nucleus would give the surface a tar-like consistency. The results from *Deep Impact* tell a different story. The large volume of dust raised by the impact indicates that the outer surface has the consistency of talcum powder. Not what anyone would have guessed.

While *Deep Impact* may not have accomplished some of the things initially anticipated, the probes worked flawlessly. And some discoveries were made, so the mission was really a success.

*[Editor's Note: This will hopefully be the first of many informative and entertaining columns by Stewart Meyers to run regularly in this newsletter. Stay tuned for future installments!]*