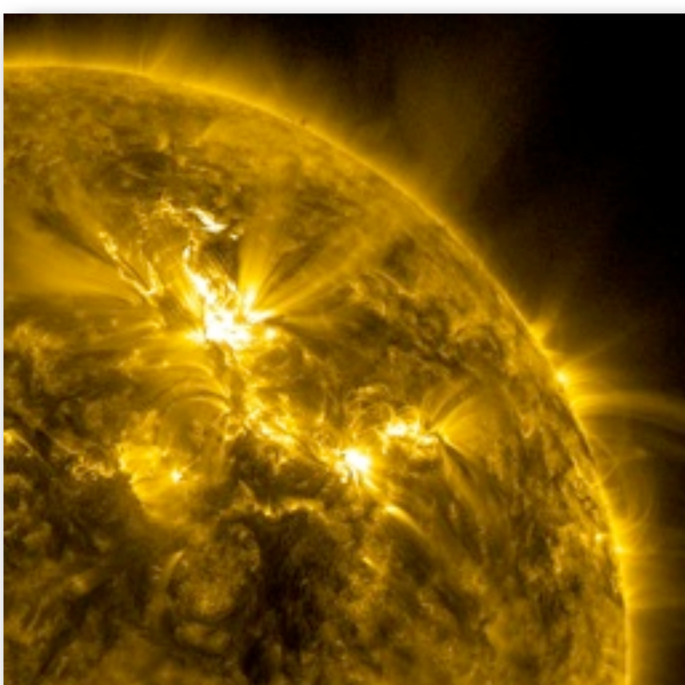
Star Gazer News

Astronomy News for Bluewater Stargazers
Vol 6 No. 3 March 2012

March 2012 Contents

Solar Flare Jan 23 Generates Aurora

Late in January, an M8.7 (quite large) solar flare erupted from the Sun accompanied by a large coronal mass ejection (CME). The tell tale brightening of the flare early on Jan 23, 2012, was followed by a burst of particles into space, then superheated magnetic loops spun up in coils above the active region as the magnetic field began to re-organize itself. The eruption sent a stream of fast-moving, highly energetic protons toward Earth, igniting the most intense solar energetic particle storm since 2005. The fast-moving CME also was headed towards Earth where it generated wonderful displays of aurora in the higher latitudes. See pg 5 of this issue for images, more are posted on http://spaceweather.com.



On a trip to Italy last May, I photographed an astrological clock on a clock tower in St. Mark's Square in Venice. It turned out to have an interesting history as described in the Wikipedia article below. The clock above is a 24-hour clock with the fancy pointer reading just after 1 pm (XIII). There is also a moon on the dial face displaying its current phase just under Aries the Ram zodiac sign.

St Mark's Clock *is the clock housed in the Clock-tower on the Piazza San Marco in Venice adjoining the Procuratie Vecchie. The first clock housed in the tower was built and installed by Gian Paulo and Gian Carlo Rainieri, father and son, between 1496 and 1499, and was one of a number of large public astronomical clocks erected throughout Europe during the 14th and 15th centuries. The clock has had an eventful horological history, and been the subject of many restorations, some controversial.*

After restorations in 1551 by Giuseppe Mazzoleni, and in 1615, by Giovanni Battista Santi, the clock mechanism was almost completely replaced in the 1750s, by Bartolomeo Ferracina. In 1858 the clock was restored by Luigi De Lucia. In 1996, a major restoration, undertaken by Giuseppe Brusa and Alberto Gorla, was the subject of controversy, amid claims of unsympathetic restoration and poor workmanship.

See http://en.wikipedia.org/wiki/St_Mark's_Clock for more details.

http://vimeo.com/36141149

Time-lapse photographer Christian Mülhauser braved sub-zero temperatures and frozen camera equipment to capture this stunning aurora footage from Norway during the last week of January 2012.

Bluewater Astronomical Society

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GREY ROOTS MUSEUM & ARCHIVES

INSPIRED BY NATURE

The Bluewater Education Foundation

BAS Events Calendar

Mar 7 BAS meeting Grey Roots Museum 7 pm Speaker: Brett T. Topic: Webster 28-inch telescope

Mar 24 BAS viewing ES Fox Observatory at dark OSFN Tour 8 pm

Mar 31 Earth Hour (8:30 pm)

Apr 4 BAS meeting Grey Roots Museum 7 pm

Ontario Trillium Foundation

Fondation Trillium de l'Ontario

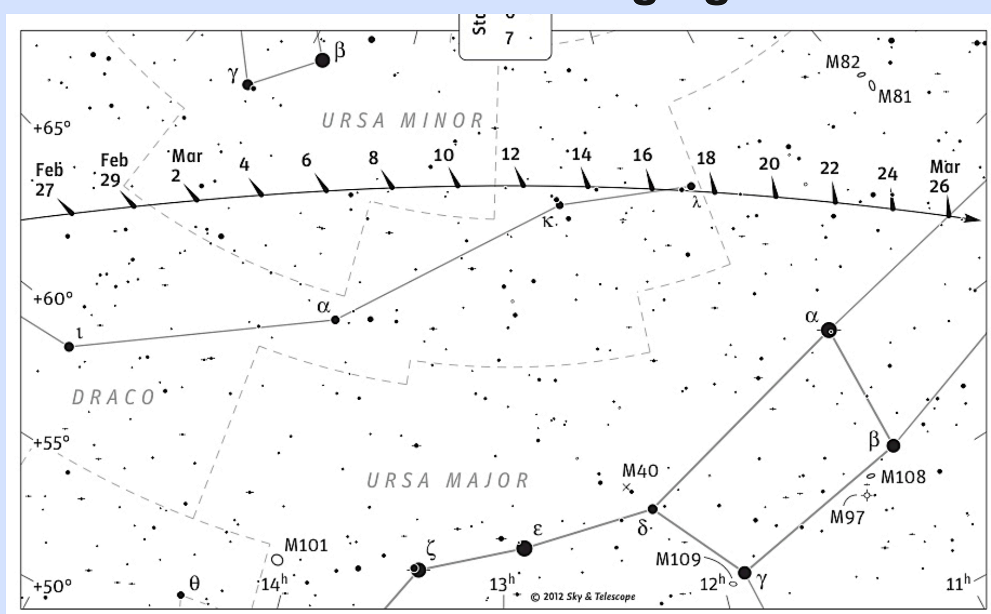
For Rent: No Charge!

For BAS Members Only:

Two 12-inch Dobsonian telescopes.

Complete with several eyepieces, collimating tool and finder. Available for use by BAS members for their viewing pleasure for periods up to 3 months, (or longer if there is no one on the waiting list). Contact Brett T or John H for availability. Free set-up lesson at a location of your choice. You transport.

Comet Garradd Hanging In



Comet Garradd (C/2009P1) has made its swing around the sun and is now visible all night long. In March, its path lies between the bowls of the dippers and so it is above the horizon from dusk to dawn. The best times to observe are when it is highest in the hours after midnight and before dawn. Moonlight interferes for the first two weeks of March but after that it is dark sky for comet watching. Garradd should be visible in binoculars as a 7th magnitude blur and it appears to be holding its brightness well. If you have a clear sky, do go out and have a look. The chart above is the March portion of the comet's path from Sky & Telescope. You can download your own hi-res copy from http://media.skyandtelescope.com/documents/WEB_May12_Garradd.pdf

Rolando Ligustri's image that was sent around in an email to BAS members (http://media.skyandtelescope.com/images/Comet_Garradd_M92.jpg) is an incredible view of the splayed tail of the comet as we look along its length. The S&T article on the comet on their website is worth reading for more details about the comet and its visibility in the next few weeks.

How Well Can Astronomers Study Exoplanet Atmospheres?

by RAY SANDERS *on* Jan 30, 2012 www.universetoday.com

Exoplanet discoveries are happening at a frenetic pace, and some of the latest newly discovered worlds are sometimes described as "Earth-Like" and "potentially habitable."

The basis of this comparison is, in many cases, based on the distance between the exoplanet and its host star. Unfortunately the distance between a planet and its host star is only half the picture. The other half is determining if an exoplanet has an atmosphere, and what the contents of said atmosphere may be.

Basically, just because an exoplanet is in the "habitable zone" around its host star, it may not necessarily be habitable. If an exoplanet has a thick, crushing, Venus-Like atmosphere, it would most likely be too hot for surface water. The opposite holds true as well, as it could be entirely possible for an exoplanet to have a thin, wispy Mars-like atmosphere where any water would be locked up as ice.

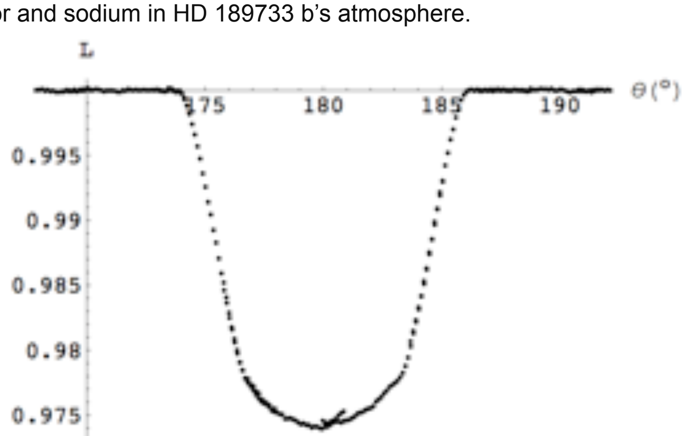
At this point, how well can astronomers study the atmosphere around an exoplanet?

One method makes use of the light coming from the host star. The basic principle is that the light from a star can be analyzed both before and after an exoplanet crosses in front of the star. By comparing the spectrum from the host star, and the spectrum of an exoplanet, the tell-tale signs of atmospheric contents can be detected.

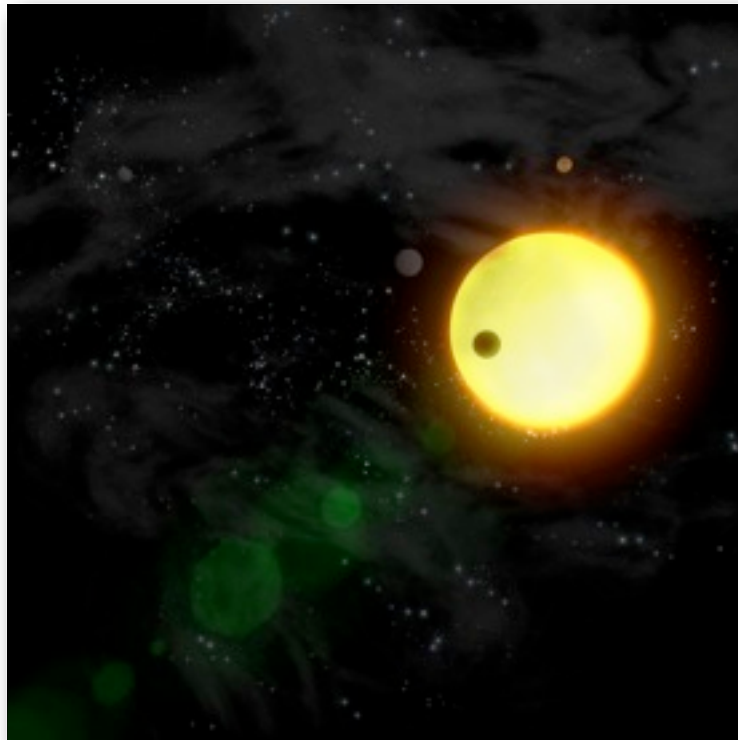
Methods to detect the atmospheric composition of such distant worlds are fairly new, as shown by work done with the Spitzer Space Telescope and ESO's Very Large Telescope.

Recently, astronomers from The Sternberg Astronomical Institute at Moscow State University used data from the Hubble Space Telescope in an attempt to better detect atmospheres around exoplanets. Abubekerov and team created mathematical models to analyze light curves from distant stars. In the case of Abubekerov's research, the selected star was HD 189733 – a K-class star a bit cooler and smaller than our Sun.

About 60 light-years from Earth, HD 189733 also happens to have a binary companion orbiting it at a radius of about 200 A.U. So far, one exoplanet is known to orbit HD 189733. Discovered in 2005, HD 189733 b is a roughly Jupiter-size exoplanet which orbits its host star in just over two days. While not mentioned directly in Abubekerov's paper, other studies have detected methane, carbon monoxide, water vapor and sodium in HD 189733 b's atmosphere.



Light curve from HD 189733 in 5500 - 6000 angstrom (Blue-Green) range.



Artist's impression of exoplanets around other stars.
Credits: ESA/AOES Medialab

By applying their models to the light curves from HD 189733, Abubekerov's team was able to better understand how light at different wavelengths behaves when an exoplanet crosses in front of its host star.

According to Abubekerov and team, the end result of their research was unsuccessful. The team suspects dark spot activity on HD 189733 was a contributing factor to their models not agreeing with actual observations.

The team stressed that additional observational data from HD 189733 when spot activity is negligible would be required to further refine their work. Despite their models not being successful, the team is confident that exoplanet radius increases with decreasing wavelength, which may imply the presence of an atmosphere.

Research such as Abubekerov's will help astronomers build better models and pave the way for "sniffing" exoplanet atmospheres. Newer technology such as the James Webb Space Telescope and the European Extremely Large Telescope will also provide better data. In the not-too-distant future, astronomers and astrobiologists should be able to examine the atmospheres of exoplanets in the habitable zone.

If you'd like to read the full research paper, you can access a pre-print version at: http://arxiv.org/pdf/1201.4043v1.pdf

Ray Sanders is a Sci-Fi geek, astronomer and space/science blogger. Currently researching variable stars at Arizona State University, he writes for Universe Today, The Planetary Society blog, and his own blog, Dear Astronomer.

New Insights into the Moon's Mysterious Magnetic Field

by IRENE ANTONENKO *on* JAN 30, 2012 Universetoday.com

Ever since the Apollo era, scientist have known that the Moon had some kind of magnetic field in the past, but doesn't have one now. Understanding why is important, because it can tell us how magnetic fields are generated, how long they last, and how they shut down. New studies of Apollo lunar samples answer some of these questions, but they also create many more questions to be answered.

The lunar samples returned by the Apollo missions show evidence of magnetization. Rocks are magnetized when they are heated and then cooled in a magnetic field. As they cool below the Curie temperature (about 800 degrees C, depending on the material), the metallic particles in the rock line up along ambient magnetic fields and freeze in that position, producing a remnant magnetization.

This magnetization can also be measured from space. Studies from orbiting satellites show that the Moon's magnetization extends well beyond the regions sampled by Apollo astronauts. All this magnetization means that the Moon must have had a magnetic field at some point in its early history.

Most of the magnetic fields we know of in the Solar System are generated by a dynamo. Basically, this involves convection in a metallic liquid core, which effectively moves the metal atoms' electrons, creating an electric current. This current then induces a magnetic field. The convection itself is thought to be driven by cooling. As the outer core cools, the colder portions sink to the interior and let the warmer interior sections move outwards towards the exterior.

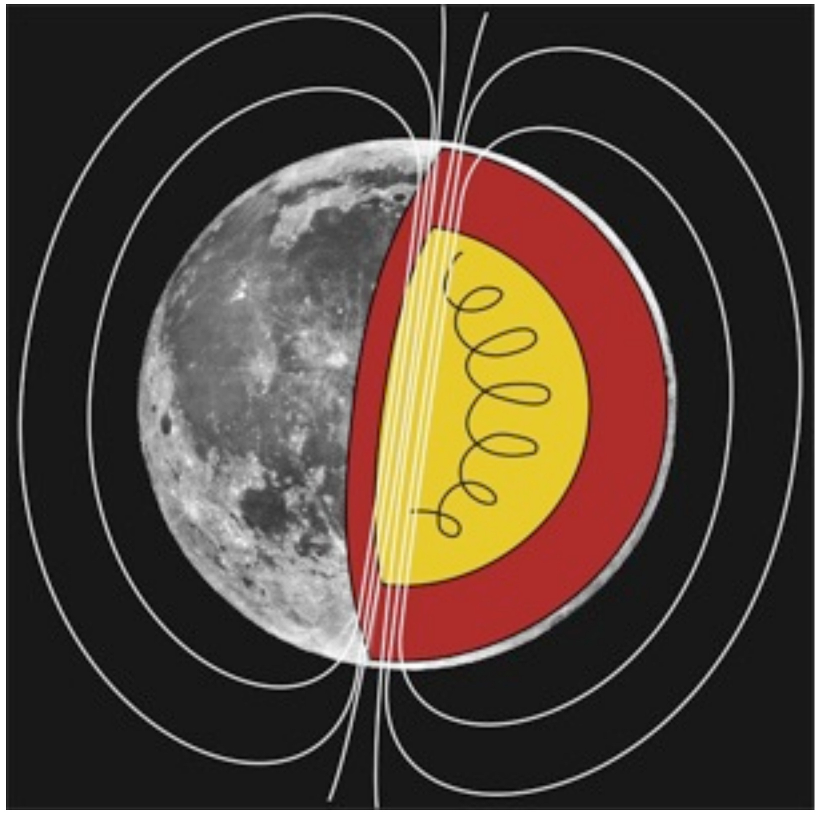
Because the Moon is so small, a magnetic dynamo that is driven by convective cooling is expected to have shut down some time around 4.2 billion years ago. So, evidence of magnetization after this time would need either 1) an energy source other than cooling to drive the motion of a liquid core, or 2) a completely different mechanism for creating magnetic fields.

Laboratory experiments have suggested one such alternate method. Large basin-forming impacts could produce short-lived magnetic fields on the Moon, which would be recorded in the hot materials ejected during the impact event. In fact, some observations of magnetization are located at the opposite side of the Moon (the antipode) from large basins.

So, how can you tell if magnetization in a rock was formed by a core dynamo or an impact event? Well, impact-induced magnetic fields last only about 1 day. If a rock cooled very slowly, it would not record such a short-lived magnetic field, so any magnetism it retains must have been produced by a dynamo. Also, rocks that have been involved in impacts show evidence of shock in their minerals.

One lunar sample, number 76535, which shows evidence of slow cooling and no shock effects, has a distinct remnant magnetization. This, along with the age of the sample, suggests that the Moon had a liquid core and a dynamo-generated magnetic field 4.2 billion years ago. Such a core dynamo is consistent with convective cooling. But, what if there are younger samples?

New studies recently published in Science by Erin Shea and her colleagues suggest this may be the case. Ms Shea, a graduate student at MIT, and her team studied sample 10020, a 3.7 billion year old mare basalt brought back by the Apollo 11 astronauts. They demonstrated that sample 10020 shows no evidence of shock in its minerals. They estimated that the sample took more than 12 days to cool, which is much slower than the lifetime of an impact-induced magnetic field. And they found that the sample is very strongly magnetized.



The dynamo effect is thought to be the cause of magnetic field generation. This diagram shows a magnetic field around the moon like Earth's. There is no measurable field like Earth's around the moon. Credit: Universe Today www.universetoday.com

From their studies, Ms Shea and her colleagues conclude that the Moon had a strong magnetic dynamo, and therefore a moving metallic core, around 3.7 billion years ago. This is well after the time a convective cooling dynamo would have shut down. It is not clear, however, if the dynamo was continually active since 4.2 billion years ago, or if the mechanism that moved the liquid core was the same at 4.2 and 3.8 billion years. So, what other ways are there to keep a liquid core moving?

Recent studies by a team of French and Belgian scientists, led by Dr. Le Bars, suggest that large impacts can unlock the Moon from its synchronous rotation with the Earth. This would create tides in the liquid core, much like the Earth's oceans. These core tides would cause significant distortions at the core-mantle boundary, which could drive large-scale flows in the core, creating a dynamo.

In another recent study, Dr. Dwyer and colleagues suggested that precession of the lunar spin axis could stir the liquid core. The early Moon's proximity to the Earth would have made the Moon's spin axis wobble. This precession would cause different motions in the liquid core and overlying solid mantle, producing a long-lasting (longer than 1 billion years) mechanical stirring of the core. Dr. Dwyer and his team estimate that such a dynamo would naturally shut down about 2.7 billion years ago as the Moon moved away from the Earth over time, diminishing its gravitational influence.

Unfortunately, the magnetic field suggested by the study of sample 10020 doesn't fit either of these possibilities. Both these models would provide magnetic fields that are too weak to have produced the strong magnetization observed in sample 10020. Another method for mobilizing the liquid core of the Moon will need to be found in order to explain these new findings.

Sources:
A Long-Lived Lunar Core Dynamo. Shea, et al. Science 27, January 2012, 453-456. doi:10.1126/science.1215359.

Jan 23 Auroral Display

Skies were overcast until approximately 12:30am local time when it cleared. Bitter cold, -15F with sustained and gusting winds between 35 & 55 mph. Had two solid hours of continuous display. Quite active. Primarily overhead and to the south (which is unusual and the pink lights of Fairbanks to the south showed up). The brighter colors were not visible to the eye, but with the longer exposures, quite nice. Nikon D3s ISO's 3200 and 6400, 16mm f2.8 and 14-24 f2.8. 3-5 secs @ f2.8.Credit: Lance Parrish, Skiland, Alaska 20 NE of Fairbanks Jan. 22, 2012

This was amazing, it was a wonderful experience to see these stunning auroras. Nikon D3S with Nikkor 14-24mm, ISO 2200, 5 and 6 sec. Bjørn Jørgensen, Grøtfjord close to Tromsø, North Norway Jan. 22, 2012

Øystein Lunde Ingvaldsen, Northern Norway
Jan. 22, 2012
Finally we got some serious northern lights over Northern Norway, and the weather was good too. These images are from Bø in Vesterålen, January 22.

"Joy of Expanding in the Whole Universe"

"I know no joy greater than learning
The joy of discovery
The joy of the union with infinity
The jot of getting lost in now
The joy of winning space and time
The joy of losing ego
The joy of completely forgetting self
The joy of expanding in the whole universe."

The Joy of Learning From "Ideas & Universe Website"

Modern technology has immeasurably enhanced the world of amateur astronomy and has facilitated the whole poetic enterprise of communing with the stars. I am referring principally to tablet computers, image stabilized optical equipment, and cutting edge astronomy software.

These 3 themes converged for me at 2:45 AM Monday morning, February 20th, 2012. I awoke and peered out through the wooden window shutters in the bedroom of our Arizona Sky Village (ASV) hacienda. I saw stars right down to the outline of the Chiricahua mountains! By then, Paula and I had been at ASV for a week and our weather the previous few days was more reminiscent of November in Ontario, with overcast skies and freezing night temperatures. I had wanted to check out the latest views of Comet Garradd (C/2009 P1) and this morning would be a perfect time to see it after its December 23rd 2011 perihelion passage.

The magnificent Garradd image that John Hlynialuk had circulated to BAS members on February 17th, had been fixed in my memory. It had been taken by Rolando Ligustri on February 3rd, 2012, from a New Mexico Skies Observatory and showed Comet Garradd with its two tails as it passed beside the Globular Cluster, M92.

Rolando Ligustri Image of Comet Garradd and Globular Cluster M92

As my Takahashi telescopes were not yet set up, I would have to find Garradd with my 15 x 50 Canon image stabilized binoculars. These binoculars are amazing! Their image stabilizing capability, combined with their crisp optics and wide FOV, make binocular observing of the heavens a delight. (In fact, Paula was so impressed with them in Zimbabwe, that she also bought the 12 x 36 IS Canon binoculars). Comet Garradd was now a rapidly moving circumpolar comet and predicted to be about 7.1 magnitude. But, where exactly was I to point my binoculars ?

Enter my new tablet computer and an amazing piece of software for modeling the astronomical sky called SkySafari 3 Pro which I purchased after reading a review of it in Sky & Telescope. This portable tablet computer has completely changed my relationship with the computer. I find that now I spend about 75% of my computer time using the tablet. It is fast, convenient, easy and comfortable to use, and, most importantly, has Apps that perform most of the functions on a desktop computer. Email, on-line banking, web surfing, worldwide chess playing, astronomy software (SkySafari 3 Pro) and newspaper/magazine reading are now all performed on the iPad 2. My particular MAC version, (there is also an Android version), was the most expensive of the 3 versions available at $59.99 US*. You can check out the company's website at http://www.southernstars.com/products/skysafari/index.html to see the complete details. SkySafari 3 Pro is the best value for all astronomy software that I own. *$39.00 on sale. -ed

So, here is how this early February morning unfolded. SkySafari 3 Pro has the largest database of any astronomy app. It contains over 15.3 million stars from the Hubble Guide Star Catalogue, 740,000 galaxies down to 18th magnitude, and over 550,000 solar system objects, including every comet and asteroid ever discovered. You can easily update the solar system's Minor Body Database because new asteroids and comets are being discovered all the time. This morning, in just 25 seconds, I had updated the data for 11,014 asteroids, 217 comets, and 676 satellites! The iPad2's display showed the detailed location of Comet Garradd in Draco. I knew the sky area well and took my Canon IS 15 x 50 IS binoculars outside and, literally within seconds, I saw Comet Garradd. It was right where SkySafari predicted! As my eyes dark adapted, I compared the comet to M101 located off the handle of the Big Dipper. Garradd was similar in size to M101 (about 24 arc minutes in diameter) but brighter at 6.8 than both M101 and the predicted magnitude of 7.0. In the wonderfully transparent Arizona skies this particular morning, I was now able to see Comet Garradd naked eye and, over the next hour, I was able to detect its movement.

This experience, as the poet said in the quote at the beginning, involved "the joy of discovery, the joy of the union with the infinity, the joy of getting lost in now"! This early morning provided a wonderful engagement with the night sky and the whole experience was enhanced by an iPad2, SkySafari 3 Pro software, and Canon IS 15x50 binoculars. I just checked SkySafari and our ClearSky Clock and, for tonight, in SE Arizona, the skies promise to be the best so far of our time here. The iPad says that Comet C/2009 P1 Garradd will still be in Draco with a visual magnitude of 7.0 at 312 million km from Earth. Amazing !

Are pulsars giant 'neutromagnets'?

Dec 13, 2011 physicsworld.com

Pulsars are created when a star collapses to form a neutron star in which the magnetic moments of the neutrons are frozen in a particular direction – much like the atomic moments in a permanent magnetic. That is the claim of two physicists in Sweden, who believe that their theory can account for many of the unexplained properties of these astronomical oddities.

First discovered in 1967, pulsars are astronomical objects that emit radiation pulses with astonishing regularity. Astronomers believe pulsars are rapidly rotating neutron stars that have very large magnetic fields. Just like the Earth, the magnetic dipole moment of the star is believed to be offset from its rotational axis. Jets of radiation are emitted from the star along its magnetic poles. Because the star is rotating about a different axis, the jet sweeps round like a lighthouse beam that appears as a regular pulse if it happens to strike Earth.

Beyond this basic description, however, little is known about the physics of pulsars and how they formed. One important question is the origin of the magnetic field, which can range from about 10^4 to 10^{11} T. That is huge compared with the Sun's magnetic field, which is about 100 μT. Furthermore, the regular nature of the pulses suggests that a pulsar's magnetic field must be extremely stable. In contrast, the Sun's magnetic field is notoriously unstable because it is generated by the rotation of the star's plasma, which is prone to instabilities.

Nuclear force favours alignment

"There is no good explanation for how the magnetic field is generated," explains Johan Hansson of Lulea University of Technology, who put forward this latest theory with colleague Anna Ponga. Hansson and Ponga suggest that the magnetic moments of all the neutrons in the star point in the same direction in a state of matter called a "neutromagnet". This is similar to the alignment of atomic magnetic moments in a ferromagnetic material. The researchers point out that the nuclear force that binds protons and neutrons together in nuclei favours the alignment of spins – an effect that they say could be enhanced in neutron stars, where neutrons are packed even more tightly together.

Hansson and Ponga assumed that the energy gained by two neutrons by aligning their spins in the same direction is about 10% of the total nuclear binding energy of the pair. This gives a Curie temperature – below which all the neutrons in the star align to become a giant magnet – of about 10^{10} K.

Because neutron stars all seem to have about the same mass, the maximum magnetic field that could result is about 10^{12} T. This would occur when all the neutrons are aligned in the same direction. However, just like everyday magnets, it is possible that different regions of the star have domains of neutrons – with each domain pointing in a different direction. This would reduce the overall magnetic field and could explain why some neutron stars have much smaller magnetic fields. According to Hansson, this maximum value of the magnetic field provides astronomers with a simple way of falsifying the theory.

Multiple observations made over several months with NASA's Chandra X-ray Observatory and the Hubble Space Telescope of the Crab pulsar. (Courtesy: NASA/ CXC/ASU/J Hester et al., HST/ASU/J Hester et al.)

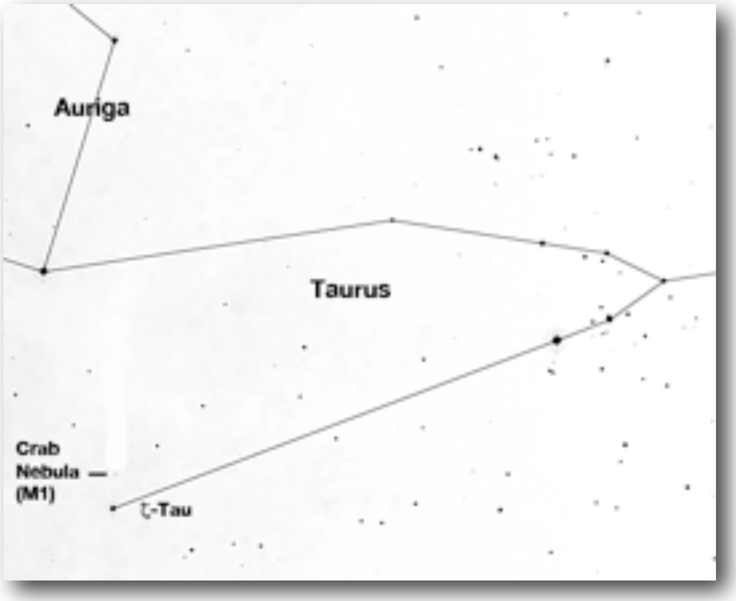
Moment is frozen in

Hansson told *physicsworld.com* that their model also explains the fixed misalignment between the magnetic moment and the rotational axis of a pulsar. "The orientation of the magnetic field is set by the direction of the star's magnetic field at the moment it collapses to form the neutron star," he explains. "The direction is then 'frozen in' by the nuclear force".

However, not all astronomers are convinced. "I don't claim that the current 'understanding' is complete or free of contradiction – the problem is very hard – but I believe that the concept presented in this paper is not nearly as good as the standard models," says Michael Kramer of the University of Manchester in the UK. The work is described in arXiv:1111.3434.

About the author:

Hamish Johnston is editor of *physicsworld.com*



ESO's Rosetta to Land on Comet

Feb. 2, 2012: Europe's Rosetta spacecraft is en route to intercept a comet– and to make history. In 2014, Rosetta will enter orbit around comet 67P/ Churyumov-Gerasimenko and land a probe on it, two firsts.

Rosetta's goal is to learn the primordial story a comet tells as it gloriously falls to pieces.

Comets are primitive leftovers from our solar system's 'construction' about 4.5 billion years ago. Because they spend much of their time in the deep freeze of the outer solar system, comets are well preserved—a gold mine for astronomers who want to know what conditions were like back "in the beginning."

As their elongated orbits swing them closer to the sun, comets transform into the most breathtaking bodies in the night sky. A European Space Agency mission launched in 2004 with U.S. instruments on board, Rosetta will have a front-row seat for the metamorphosis.

What we know of comets so far comes from a handful of flyby missions.

"In some ways, a flyby is just a tantalizing glimpse of a comet at one stage in its evolution," says Claudia Alexander, project scientist for the U.S. Rosetta Project at JPL. "Rosetta is different. It will orbit 67P for 17 months. We'll see this comet evolve right before our eyes as we accompany it toward the sun and back out again."
Fierce solar heat will have a profound effect on Rosetta's target. "We'll watch the comet start as just a little nugget in space and then become something poetic and beautiful, trailing a vast tail."

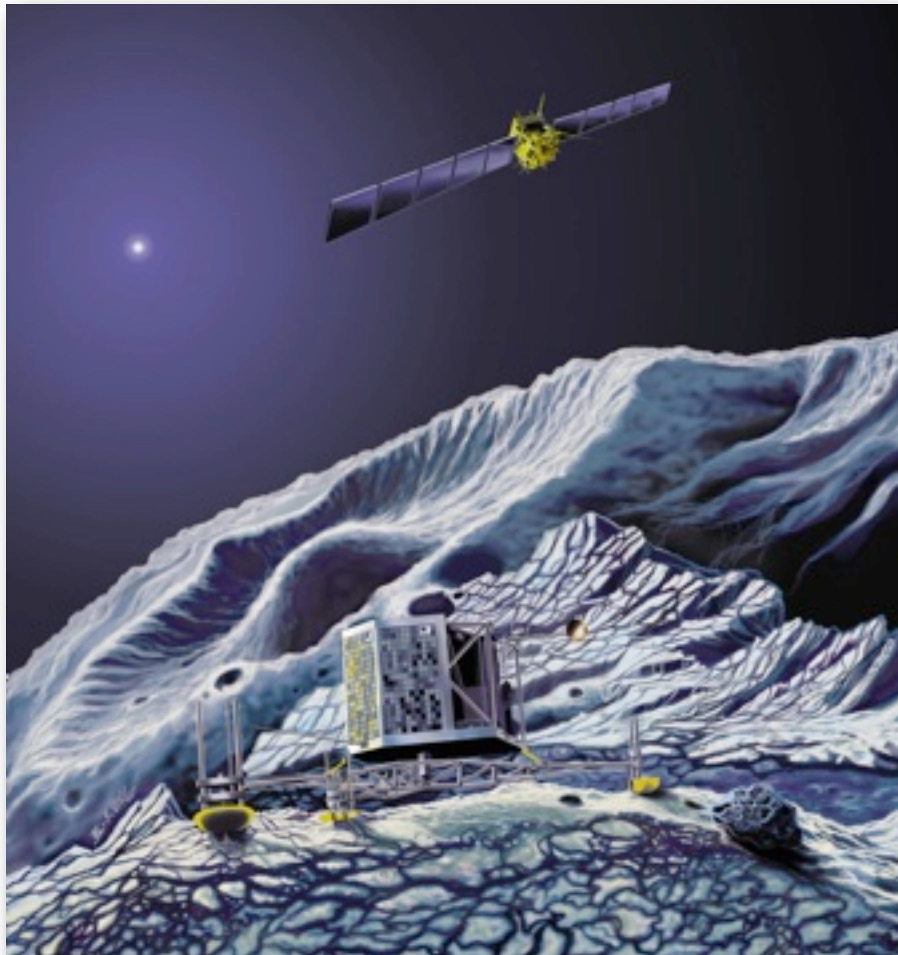
At the moment, Rosetta is "resting up" for the challenges ahead. It's hibernating, engaged in its high-speed chase while fast asleep.
Reveille is on or around New Year's Day 2014, when the spacecraft begins a months-long program of self-checkups.

If all goes well, in August of the same year, Rosetta will enter orbit around 67P's nucleus and begin scanning its surface for a landing site. Once a site is chosen, the spacecraft will descend as low as 1 km to deploy the lander.

The lander's name is "Philae" after an island in the Nile, the site of an obelisk that helped decipher—you guessed it—the Rosetta Stone.

Touchdown is scheduled for November 2014, when Philae will make the first ever controlled landing on a comet's nucleus.

"When we land, the comet could already be active!" says Alexander. Because a comet has little gravity, the lander will anchor itself with harpoons. "The feet may drill into something crunchy like permafrost, or maybe into something rock solid," she speculates.



Rosetta orbiter 'swoops' over the Philae lander soon after its touchdown on Comet 67P/Churyumov-Gerasimenko.

Credits: Astrium - E. Viktor

Once it is fastened, the lander will commence an unprecedented first-hand study of a comet's nucleus. Among other things, it will gather samples for examination by automatic onboard microscopes and take panoramic images of the comet's terrain from ground level.

Meanwhile, orbiting overhead, the Rosetta spacecraft will be busy, too. On board sensors will map the comet's surface and magnetic field, monitor the comet's erupting jets and geysers, measure outflow rates, and much more.

Together, the orbiter and lander will build up the first 3D picture of the layers and pockets under the surface of a comet.

The results should tell quite a story indeed.

Author: Dauna Coulter | Editor: Dr. Tony Phillips | Credit: Science@NASA

You can see a video on the Rosetta mission at:

http://www.esa.int/esaMI/Rosetta/SEMYMF374OD_1.html

SGN Featured Constellations: **Aries and Taurus**

Aries

γ Arietis - Mesarthim

Even though its four most prominent stars lie well to the north of the ecliptic, Aries is a zodiacal constellation, the smallest in scope of the twelve. Aries was a famous constellation to the ancients; 2,000 years ago the vernal equinox lay in this group. However, due to the precession of the equinoxes this point has shifted westward and now lies in the constellation Pisces. [A fact that many astrologers fail to consider in their predictions. -ed]

Double Stars	Mag.	Separation (s)	Location	Remarks
γ	4.8-4.8	8	015119	White-Pale Grey
λ	4.8-7.6	38	015523	White· Blue
π	4.9-8.4-10.5	3-25	024717	Triple.
1	6.2-7.6	3	014722	
30	6.6-7.4	28	023424	Yellow-Grey; beautiful.
33	5.4-9.0	29	023727	Topaz-Sapphire; fine contrast.

Many of the Pleiades Cluster stars are doubles. See pg 380 of **Vol 1: Night Sky Observer's Guide** (Kepple and Sanner) for a chart of magnitudes and separations (or email the editor for a copy of the data).

Taurus

α–Tauri - Aldebaran γ–Tauri - Hyadum Primus
η–Tauri - Alcyone β–Tauri - Nath ε–Tauri - Ain

Taurus is a zodiacal constellation and is one of the oldest of the star groups, being recognized by the ancient Babylonians, Persians, Egyptians and Greeks. A V-shaped group of stars, the well-known Hyades Cluster, form the bull's face; Aldebaran, a great red star, is the bull's right eye; it ranks 13th in brightness, having a magnitude of 1.0. Nath, at the tip of the bull's left horn, would seem to properly belong to the constellation Auriga; it is shared by both constellations. The best known feature of Taurus is the beautiful cluster of stars known as the Pleiades, M 45, a compact group located in the bull's shoulder. Six of these stars are visible to the naked eye; an observer with keen eyesight can sometimes see seven. The Pleiades are a beautiful sight in fieldglasses, 30 to 40 stars being visible. This cluster is most impressive at low power. The Pleiades are named (see chart) after the daughters of Atlas, the giant who supported the world. All the stars named on the chart in this group are not visible to the naked eye, but are easily observable in binoculars. θ1 and θ2 Tauri are a pretty pair visible to the naked eye and an attractive pair in fieldglasses.

Double Stars	Mag.	Sep (s)	Location	Remarks
α	1.0-11.2	31	043316	Gold-Pale Red.
τ	5.0-8.5	63	043923	White-Blue.
θ	5.1-8.5	52	041727	Red-Blue.
χ	5.4-7.5	19	041925	
30	5.0-10.0	9	034611	Green-Purple.
62	6.2-8.0.	29	042124	Many stars in this field.
88	4.4-8.0	69	043310	
Σ422	6.0-8.2	7	033400	Gold-Blue.
Σ430	6.0-9.0-9.8	26-37	033805	Triple.
Σ495	6.0-8.8	4	040515	
Σ548	6.0-8.0-10.3	15-121	042630	Triple.
Σ645	6.2-8.2	12	050728	White-Ashen.
Σ674	6.5-9.5	10	051620	
Σ716	5.8-6.6	5	052725	A striking pair.
Σ730	6.5-7.0	10	053017	

Messier Objects

	Mag	Location	Remarks
M 1	8.4	053222	Planetary Nebula. The famous "Crab Nebula," a still-expanding cloud from a supernova explosion in 1054 A.D. Visible as a faint misty patch in a small telescope.
M45	1.6	134524	Open cluster. The Pleiades. See left.

Other Objects of Interest

λ Tauri - Eclipsing variable, magnitude range 3.8-4.1, period 3 days 22 hr. 52 min. Location 035812.

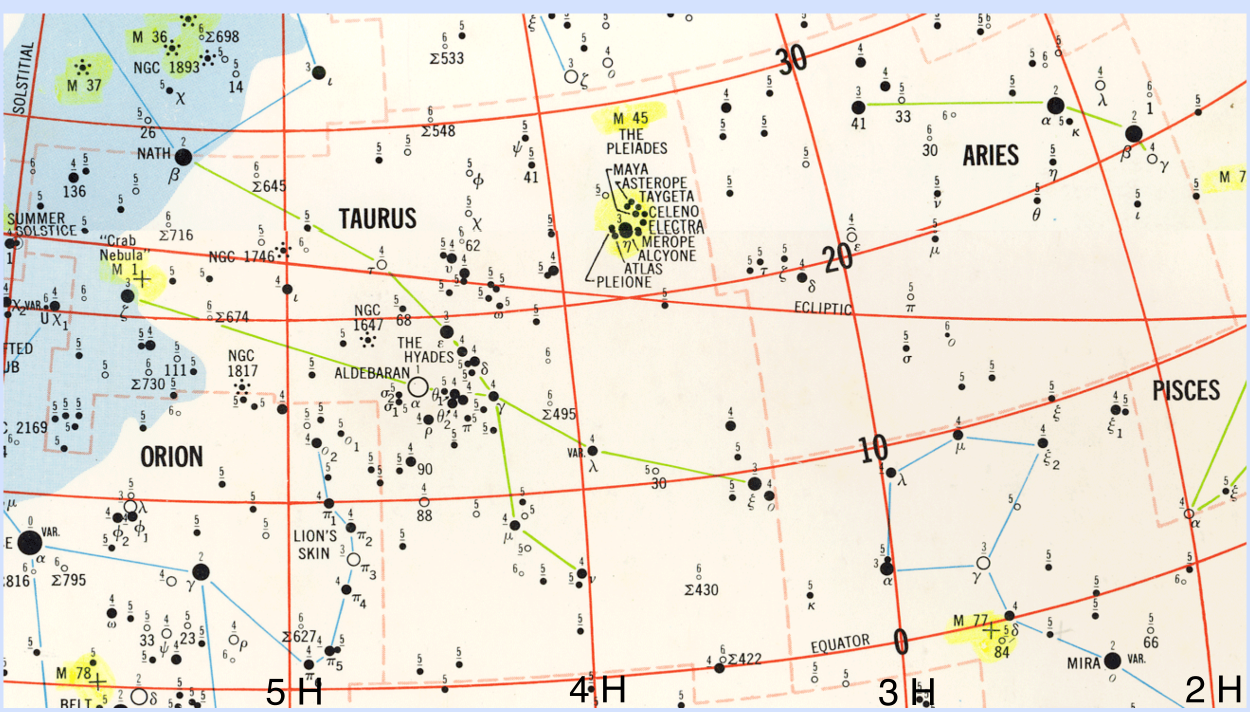


Chart Legend
- Star Location
- Double Stars
- Nebulae
- Clusters
- Variable Stars Var

Star magnitudes are labeled as numerical values above (or near) the star. Underlined values are half magnitudes. Larger star dots denote brighter stars.

Sky Calendar March 2011

compiled by John Hlyniluk (**stargazer@wightman.ca**) using the Observer's Handbook 2012(RASC), Sky and Telescope and Sky News magazines. Please contact the editor if you notice any errors.

Feb 29	**First Quarter Moon rises at 10:33 am EST**
Mar 3	**Mars at Opposition (mag -1.2)**
Mar 5	**Mercury greatest elongation E (18°)**
	Mars Closest to Earth (0.674.au)
Mar 6	Mercury 3° N of Uranus
Mar 8	Mars 10° N of Moon
	Full Moon (Sap Moon) rises at 5:55 pm EST
Mar 10	Zodiacal Light visible in West after sunset for next two weeks
	Spica 1.5° N of Moon
Mar 11	**DST begins 2:00 am**
	Saturn 6° N of Moon
	Venus about 3° from Jupiter for next 3 nights
Mar 15	**Last Quarter Moon rises at 3:16 am DST**
	Venus 3° N of Jupiter
	Double shadow transit on Jupiter starts 7:25 pm
Mar 20	**Spring Equinox (1:14 am DST)**
Mar 22	**New Moon rises at 6;59 am DST**
	Double shadow transit Jupiter starts 10:34 pm
Mar 26	Jupiter 3° S of Moon
	Venus 1.8° N of Moon
Mar 27	**Venus greatest elongation E (46°)**

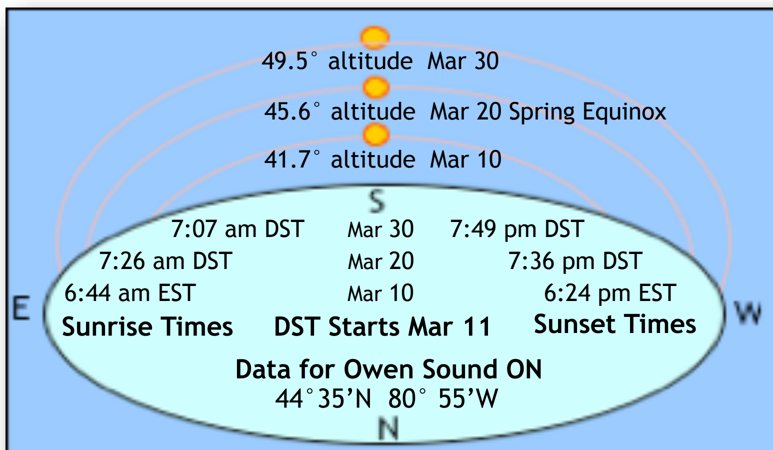
BAS Events

Mar 7	BAS meeting Grey Roots Museum 7 pm Speaker: Brett T. Topic: Webster 28-inch telescope
Mar 24	BAS viewing ES Fox Observatory at dark OSFN Tour 8 pm
Mar 31	Earth Hour (8:30 pm)
Apr 4	BAS meeting Grey Roots Museum 7 pm

Planets

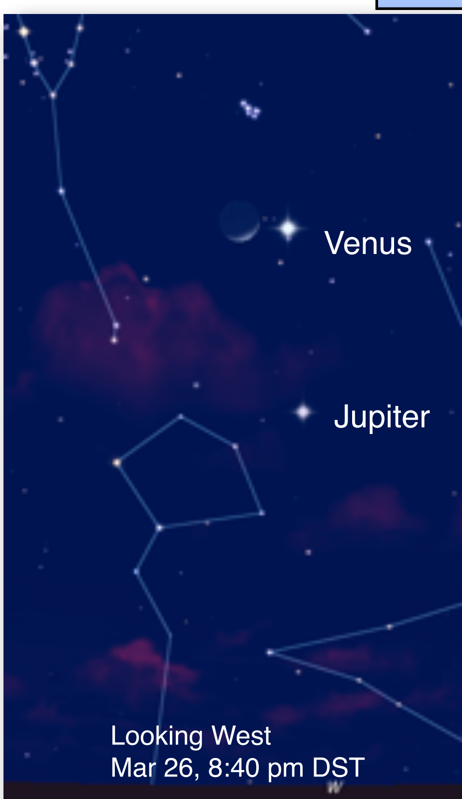
MERCURY, gets away from the sun this month and is high enough around Mar 5 to be seen above the western horizon. It then quickly drops back towards the sun. **VENUS**, (-4.3), has been accompanied by a second evening star this month, Jupiter, above the western horizon. The two are only 3° apart on Mar 12/13. There is a thin crescent moon near Venus (again) on Mar 26. **MARS** brightens to mag -1.2 at opposition on Mar 3 but the planet is at its farthest distance for an opposition in 30 years. Only 13.9" across, detail is difficult to see but don't let that stop you. A steady night can still reveal polar caps and other markings. **JUPITER**, (mag -2.1) is now setting in the west before 11 pm. Venus is very close (3°) Mar 12/13 and the crescent moon passes Jupiter on Mar 25. It is a nice grouping of planets (see Special Events). **SATURN**, (mag 0.4), rises in the east about 9 pm by month-end and appears near Spica all March. **URANUS**, (5.8) is too close to the sun to see this month. **NEPTUNE**, (7.9) rises in the east just before sunrise by month end but is a difficult target in twilight. Ceres is now only visible in evening twilight as it gets closer to the sun. See chart on pg 5 of the Sep issue. **PLUTO** rises in the east just before sunrise and may be found with accurate charts and large telescopes.

The diagram below gives the sunrise/sunset times and the sun's altitude on three dates this month. The calendar below the sun chart shows the moon phases for the month. Times of moonrise for NM, FQ, FM and LQ are in the Sky Calendar listing at left. Note that spring starts on March 20.



Special Events

All 5 Naked Eye Planets Before Midnight!



Venus continues to dazzle in the western sky all this month and into the spring. It slips past Jupiter, the second brightest planet in the sky on Mar 12 (a touch less than 3°). Eventually, (Apr 3) it passes just below the Pleiades. More about that next month. On Mar 5, Mercury is highest above the horizon and in line with Venus and Jupiter so potentially, if you spot Mars and Saturn (explained below) you can see all five of the classical naked-eye planets in one night.

In the eastern sky, during the first part of March (7th to 10th) a waning gibbous moon is located first under Mars, and then, under Saturn. Do not fail to observe Mars this month, -it is at opposition and its brightest (-1.2 mag). Some surface details should be visible even though it is about as distant a close approach that Mars can make. (It will be much better in 2018.) Saturn closely follows Mars rising around 10 pm near Spica.

Back in the western sky, from March 24 to 27, the crescent moon moves past Venus and Jupiter and sits pretty between the Pleiades and Hyades on March 27. Mercury is just above the western horizon in early March as well, so it is possible to see the 5 classical naked eye planets before midnight on a clear night during the first week of the month.