Southwest Florida Astronomical Society
SWFAS

The Eyepiece
April 2015

Contents:

A MESSAGE FROM THE PRESIDENT

Spring is finally here, but so is Daylight Savings Time!

Jupiter and Venus are very well placed for us this season. The Great Red Spot and Moon Transits have been spectacular. Chuck Pavlick has several nice pictures of Jupiter. The one with the moon at the edge of the disk was just how we saw it at the CRP Star Party. Clouds were around but we did have some nice holes and some interesting people attended including some from Naples and Bradenton.

Astronomy Day is April 25th for Spring and Sept 19th for Fall. Do we want to do anything special?

The program on Planetary Nebulae by Heather at last month's meeting was great! This month we have Jack Berninger talking about the Search for ETs this month. Please Note: the program will be before the business meeting!

We still have some of the eyepieces that Tony Heiner has for sale for FL SouthWestern observatory. Make Tony offers!

This is one of my last dues reminders! If you haven't paid for 2015, please pay Tony at the meeting or send your $20 annual dues to: SWFAS, Inc. PO Box 100127, Cape Coral, FL 33910-0127.

At this time, looking for a program for the May 7th Meeting.

Brian

In the Sky this Month

Moon: April – Full, 4th; Last Quarter, 12th; New, 18th; 1st Quarter, 25th.
On morning of April 4th a lunar eclipse will occur. However, the moon will be setting at sunrise before we have a chance to see totality.

The Planets:
Venus continues to dominate the western sky during dusk at -4.1 magnitude. The sunlit portion of its disc will shrink to 68% during the month as its orbit closes with earth.
Mercury will reappear at dusk in last third of the month and shine at -1.4 magnitude low in the west.
Mars glimmers at a dim 1.4 magnitude. It is gradually sinking toward the horizon, but will be above brighter Mercury all month.
Jupiter will be featured all month long high overhead at magnitude -2.2. You'll find it near the Beehive Star Cluster, M44.
Saturn will be rising around 9:30 pm near month's end at magnitude 0.1. It will linger all month near the head of the Scorpion.

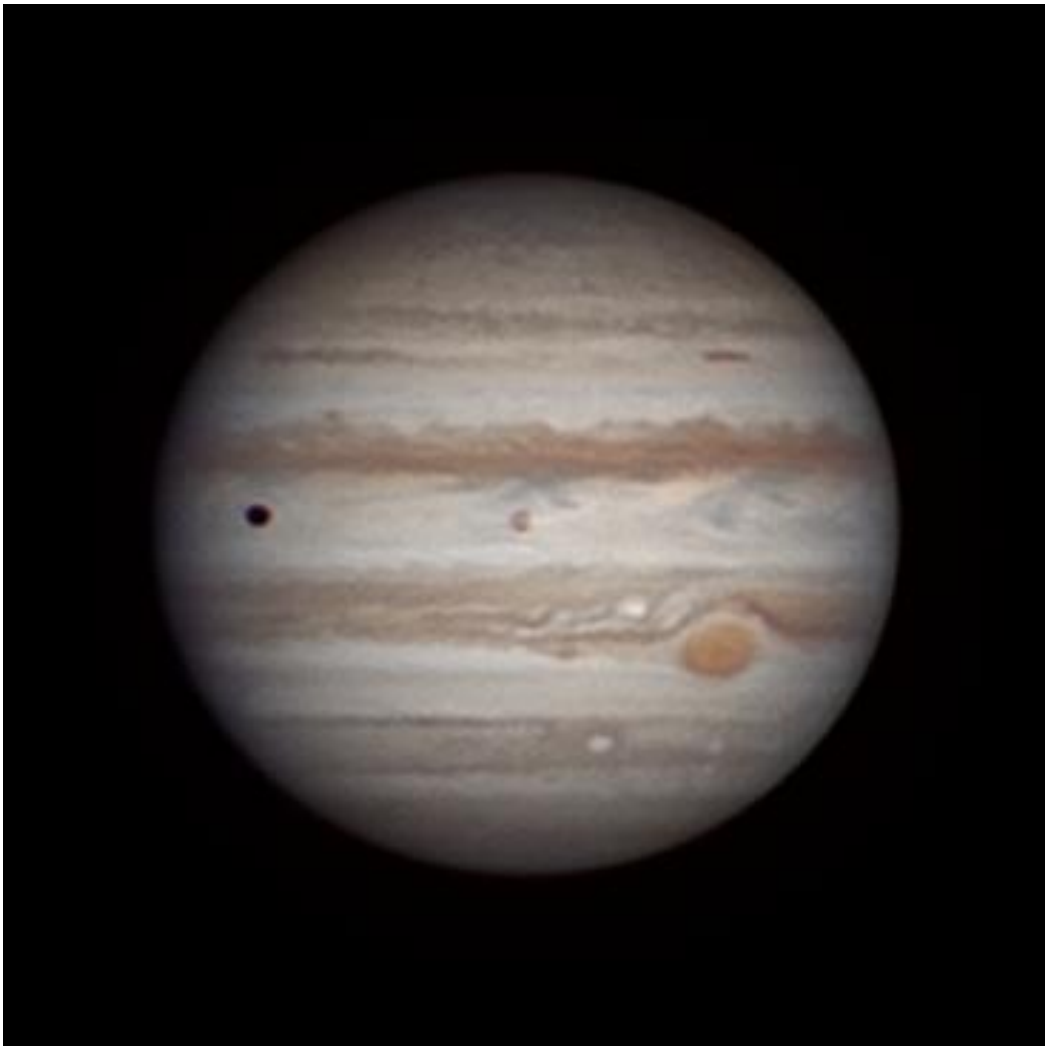
Lyrid Meteors – The Lyrids are a minor meteor shower that will occur on night of April 22-23. The radiant is between Lyra and the Keystone of Hercules. Peak time is from 11 pm to dawn.

International Space Station: There are several good evening viewing opportunities for the ISS month. They will occur April 1-3, 22-26, and 28, generally between 8 and 9 pm EDT. Check website for specific viewing times.
http://www.heavens-above.com/

Photos by Chuck – A focus on Jupiter

Jupiter 3-19-15

Jupiter with Great red Spot, Io, and Io's Shadow



Jupiter 3-15-15

Jupiter and Io

Seagull Nebula-IC2177

Future Events

Star Party and Event Schedule

Date	Event	Location	Time	Info/Contact
Thursday April 2nd	Monthly Meeting – Program: Jack Berninger	Calusa Nature Center & Planetarium	7:30program followed by business meeting	Brian Risley
April 18th	Star Party		Dusk	Bruce Dissette
Thursday May 7th	Monthly Meeting	Calusa Nature Center & Planetarium	7:30	Brian Risley
May 16th	Star Party		Dusk	Bruce Dissette
Thursday June 4th	Monthly Meeting	Calusa Nature Center & Planetarium	7:30	Brian Risley
June 13th	Star Party		Dusk	Bruce Dissette
July 18th	Star Party		Dusk	Bruce Dissette
August 15th	Star Party		Dusk	Bruce Dissette
Sept. 12th	Star Party		Dusk	Bruce Dissette
October 10th	Star Party		Dusk	Bruce Dissette
November 14th	Star Party		Dusk	Bruce Dissette
December 12th	Star Party		Dusk	Bruce Dissette

Minutes of March SWFAS Meeting –March 5th, 2015

The regular monthly meeting of the Southwest Florida Astronomical Society was called to order at 7:34 pm by president Brian Risley in the Calusa Nature Center Planetarium.

There were 39 people present.

A wireless microphone for the planetarium was purchased. Tom Segur made a motion to approve the purchase, with a second by Isaac Osin. The motion carried on a voice vote.

Past events listed on the printed agenda were reviewed.

Dick Gala donated a lamp for the planetarium projector.

A discussion was held regarding proposed electronic bill boards in Cape Coral, and the potential for increased light pollution. Cape Coral City Council will always listen to concerns of residents.

Requests have been received from schools for daytime programs. Check with Brian Risley regarding taking the PST.

Mike McCauley made a motion, seconded by Carlos Perosio, to approve the February 5 minutes as contained in the newsletter. The motion carried on a voice vote.

Treasurer Tony Heiner reported a February balance of $2437.68. Ray Wolf made a motion, seconded by Tom Segur, to accept the report. The motion carried on a voice vote.

Librarian Maria Berni reported some new books are available.

Equipment Coordinator Brian Risley reported that the CPC and PST are more available for member use now that public events are ending.

Website coordinator Bill Francis is working on changes to the website. Becky Brooks will set up a club Facebook page, but needs people to help with answering astronomy questions. Contact Brian Risley to get in touch with Becky.

For the April meeting the program will be presented first and the business meeting will follow. The program will be Jack Berninger on the search for extraterrestrial life.

Astronomical League Coordinator Carol Stewart will be updating the membership roster for April 15.

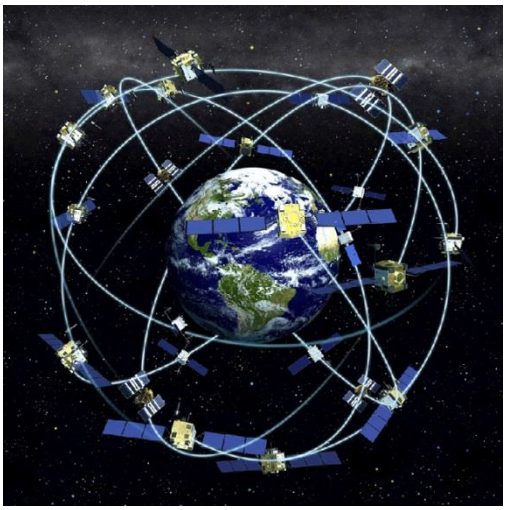
The Sun newspaper had an article about Tony Heiner, the Florida Southwestern State College observatory, and the asteroid eclipse.

The business meeting was adjourned at 8:29.

Heather Preston presented a program on Planetray Nebulae, many new details being discovered, and theories to explain the observations.

submitted by Don Palmer, secretary

How does GPS work?



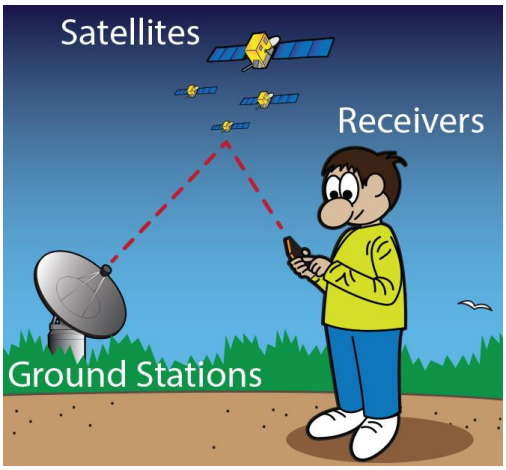
Earth is surrounded by navigation satellites. Credit: NOAA.

Humans have looked to the skies to find their way since ancient times. Ancient sailors used the constellations in the night sky to figure out where they were and where they were going.

Today, all we need is a simple hand-held GPS (short for Global Positioning System) receiver to figure out exactly where we are anywhere in the world. But we still need objects high in the sky to figure out where we are and how we get to other places.

Instead of stars, we use satellites. Over 30 navigation satellites are zipping around high above Earth. These satellites can tell us exactly where we are.

What is GPS?



The Global Positioning System (GPS) is made up of satellites, ground stations, and receivers.

GPS is a system. It's made up of three parts: satellites, ground stations, and receivers.

Satellites act like the stars in constellations—we know where they are supposed to be at any given time.

The ground stations use radar to make sure they are actually where we think they are.

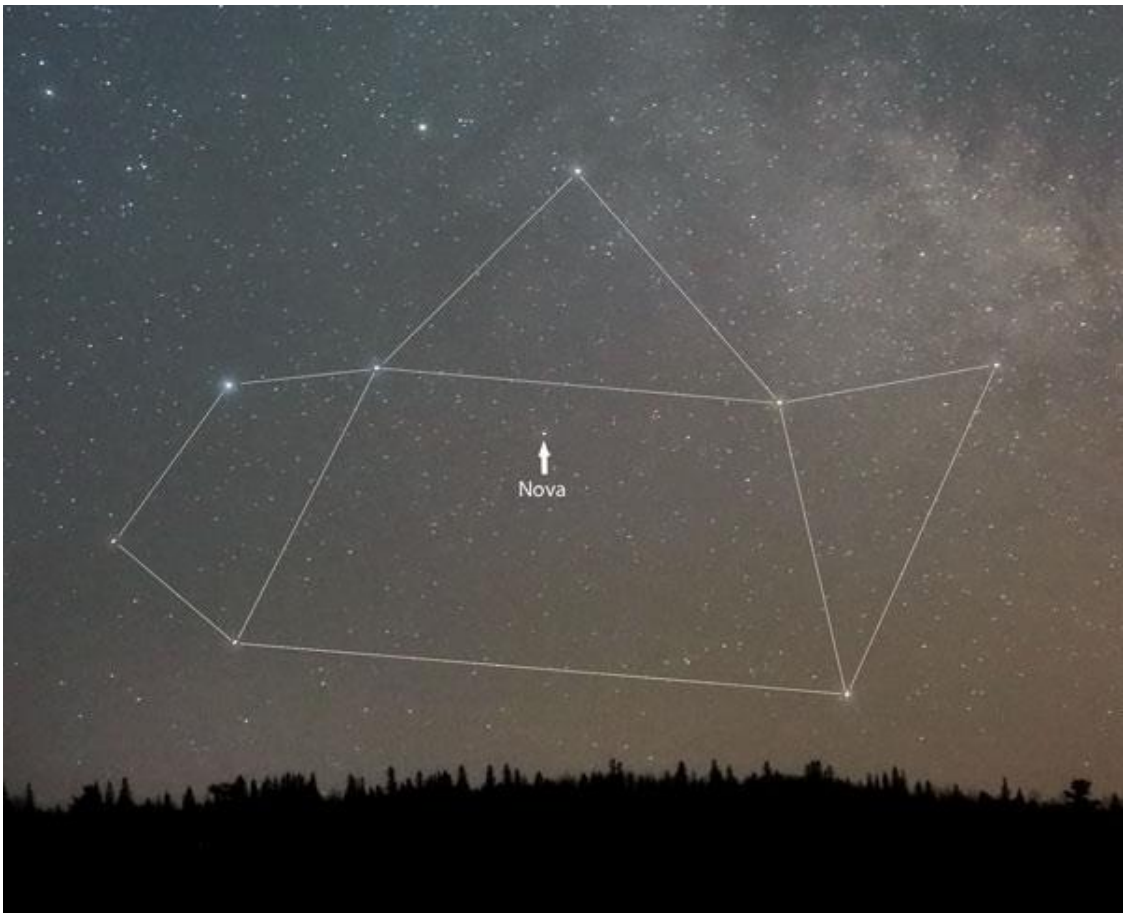
A receiver, like you might find in your phone or in your parents car, is constantly listening for a signal from these satellites. The receiver figures out how far away they are from some of them.

Once the receiver calculates its distance from four or more satellites, it knows exactly where you are. Presto! From miles up in space your location on the ground can be determined with incredible precision! They can usually determine where you are within a few yards of your actual location. More high-tech receivers, though, can figure out where you are to within a few inches! The ancient sailors of history would be flabbergasted by the speed and ease of pinpointing your location today.

Nova Sagittarii Rebrightens!

By: Alan MacRobert

The brightest nova since 2013 peaked and dimmed, but now its behavior is quite unsettled. It's an easy catch in binoculars before dawn, a bit higher every morning.



Nova Sagittarii 2015 No. 2 on the morning of March 21st at its peak brightness. Image by Bob King.

Update March 27: A rebrightening. **To judge by the AAVSO's preliminary light curve, Nova Sagittarii has bumped up again to about magnitude 5.0 after declining to about 5.8. Its spectrum has been changing in unexpected ways too. What's going on?**

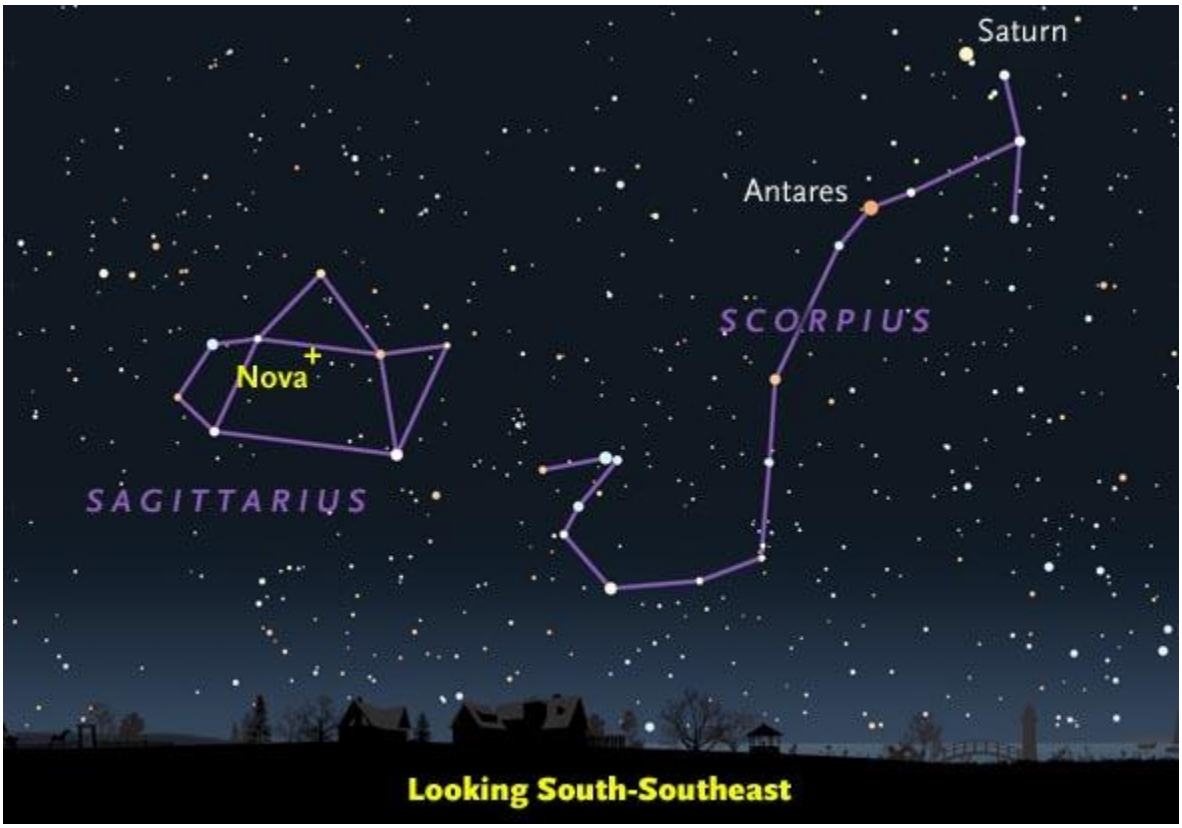
[Original text, March 23:]

If you're a slug-a-bed waiting for a comfortable morning to get up before dawn to catch the nova that popped up in Sagittarius on March 15th, your window of opportunity is closing.

In just the last day, Nova Sagittarii 2015 No. 2 unexpectedly dropped a magnitude to about mag. 5.4 from its peak brightness of about 4.3.

Do you think of Sagittarius just as a summer constellation? In late March it glitters low in the southeast right before the start of dawn for the world's mid-northern latitudes. Farther south it's higher before dawn, but even in Canada's heavily populated latitudes, earlybirds will find it in view from any spot with a view low to the southeast.

And it's getting a little higher every morning. To find when morning astronomical twilight begins at your location, you can use our online almanac. (If you're on daylight time like most of North America, be sure to check the Daylight-Saving Time box.)



The nova is almost on the midline of the Sagittarius Teapot. The horizon here is drawn for shortly before the the beginning of morning astronomical twilight in mid- to late March for a viewer near 40° north latitude. The nova is about 15° above this horizon; it will be higher in April. Stars are plotted to magnitude 6.5. For more detailed charts with comparison-star magnitudes, see the bottom of this page. *Sky & Telescope map.*

How a Nova Works

This "new" star is definitely one to bag for your logbook. It's the brightest nova in Sagittarius since at least 1898, and the brightest anywhere in the sky since Nova Centauri 2013 peaked in mid-December of that year at magnitude 3.3.

Classical novae are not all alike. Their underlying mechanism is the same: a white-dwarf star collects gas, mostly hydrogen, from a close companion star that's overflowing its gravitational boundary and spilling a stream to the white dwarf, like a trickle of water overflowing a tilted bucket. (In a close binary star, the gravity-and-momentum environment is not intuitive.) As the fresh hydrogen builds up on the white dwarf's surface, the bottom of this layer becomes compressed ever more intensely by the dwarf's powerful gravity. Eventually the layer's bottom becomes dense and hot enough to ignite in a runaway hydrogen-fusion reaction, which quickly spreads around the whole star — the layer becomes an H-bomb in the form of a thin shell.

The hot blast of material expands outward and remains opaque for a while, looking from the outside as if the whole star is swelling enormously. The brightness typically jumps by 10 magnitudes. Yet the shell contains only about 1/10,000 of a solar mass. In the following days or weeks the ever-widening shell cools, thins, and becomes transparent, fading and allowing the original star system in its middle to shine through. The white dwarf eventually settles down to its previous state, the gas stream from its companion resumes, and the cycle begins anew — building toward the next explosion in anything from a few years to tens of thousands of years. The more massive the dwarf and the stronger its gravity, the faster the explosions usually repeat.

In a supernova, by contrast, an entire star explodes completely and for good.

Classical novae may all work alike, but their light curves often behave differently. Clearly, other things influence the course of events. Sudden brightness drops like the one happening now are unusual. It could halt or even reverse at any time.

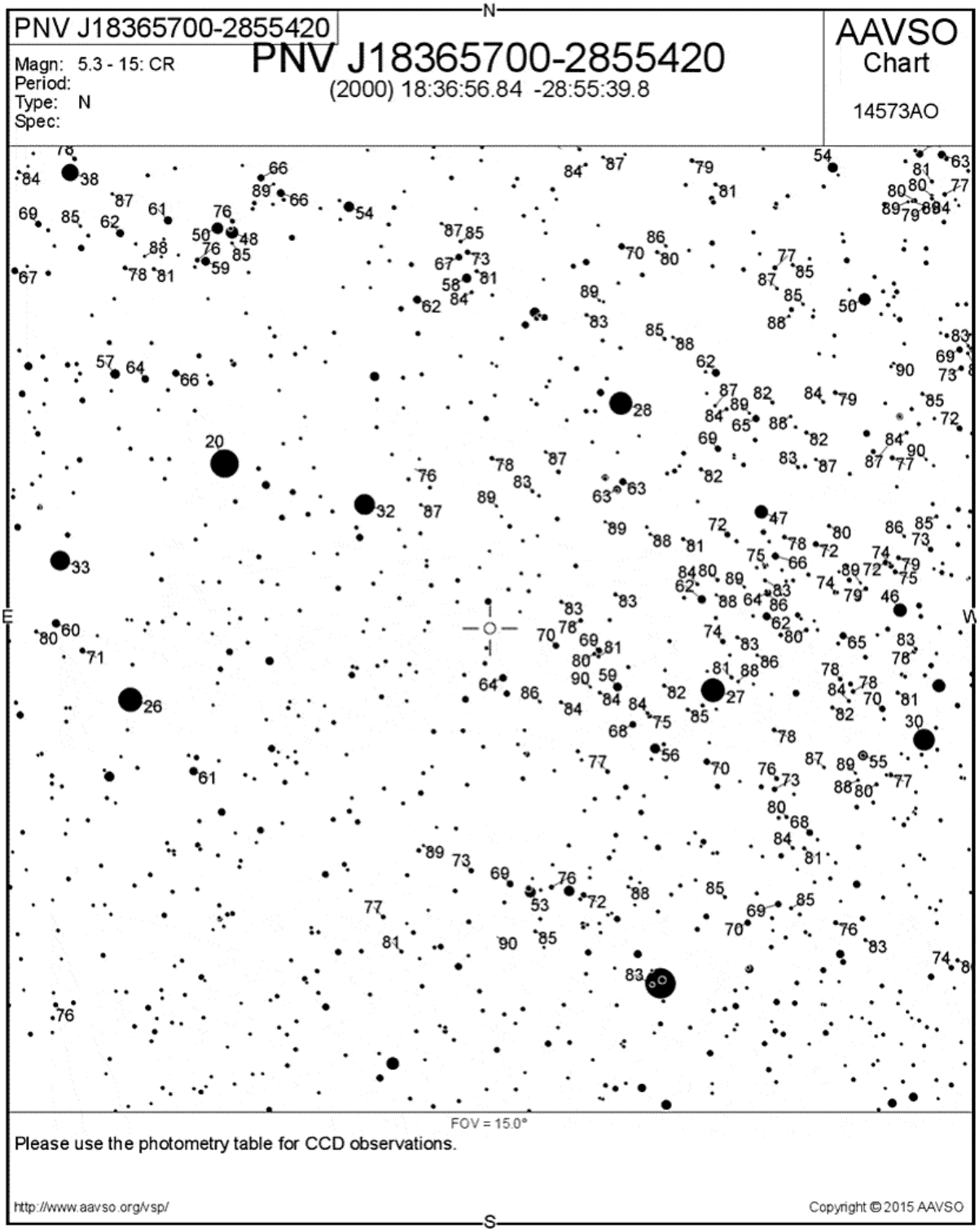
About 10 novae in the Milky Way are discovered each year, out of the 40 that are estimated to take place throughout the galaxy.

Here's the nova's up-to-date preliminary light curve from the American Association of Variable Star Observers (AAVSO), filled in as members' observations arrive. Here is the AAVSO's list of recent observations.

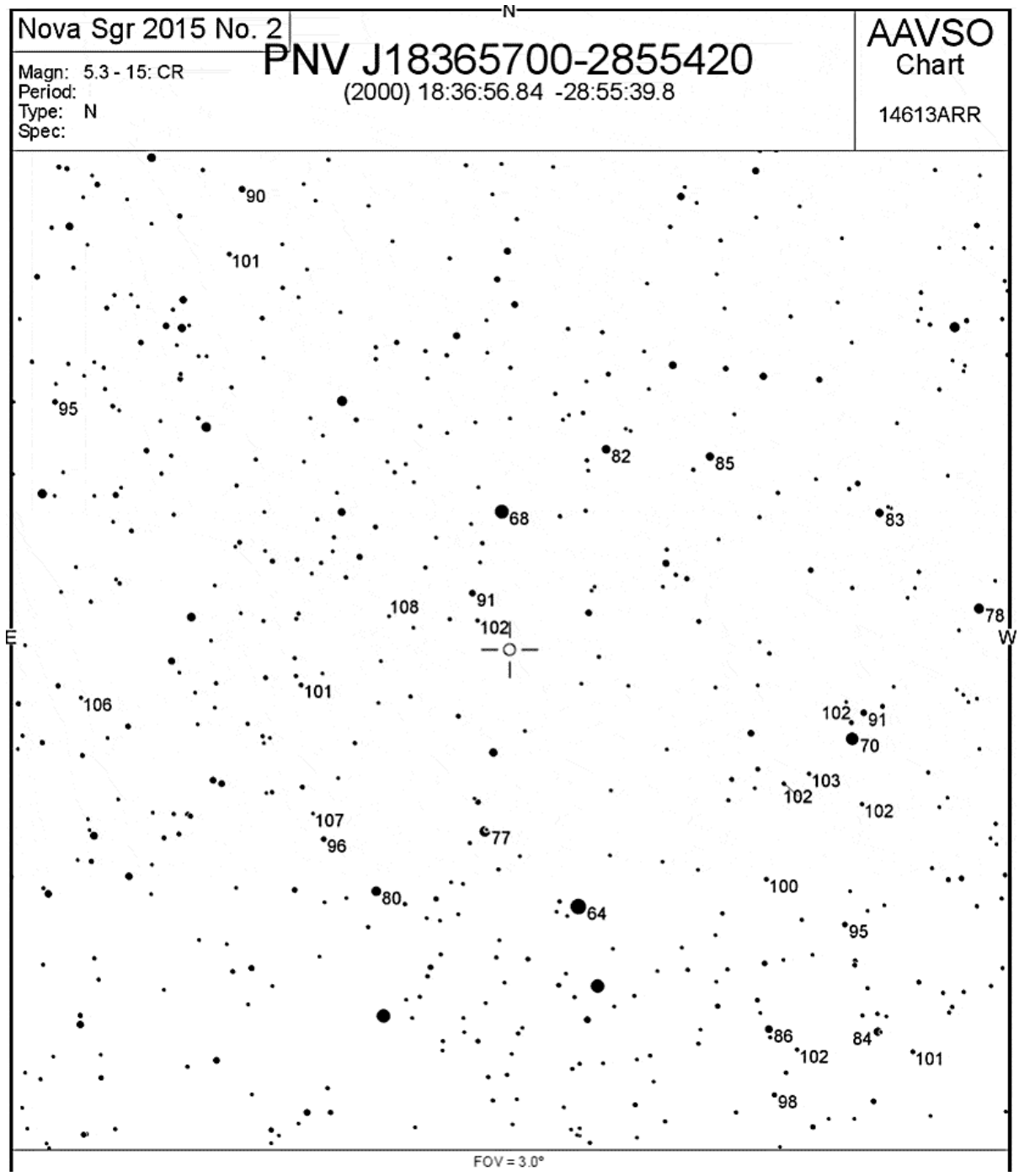
The nova's yellow color in the eyepiece seems to be deepening. Here's a color image of its spectrum taken March 17th, by Jerome Jooste in South Africa using a Star Analyser spectrograph on an 8-inch reflector. Note the wide, bright emission lines. They're flanked on their short-wavelength ends by blueshifted dark absorption lines: the classic P Cygni profile of an object with a thick, fast-expanding cooler shell or wind.

Below are comparison-star charts from the AAVSO, for estimating the nova's brightness. Stars' visual magnitudes are given to the nearest tenth with the decimal points omitted. The nova is at declination –28° 55′ 40″, right ascension 18^h 36^m 56.8^s (2000.0),

Check back for more updates.



The cross at center is Nova Sagittarii 2015 No. 2. Magnitudes of comparison stars are given to the nearest tenth with the decimal points omitted. The frame is 15° wide, two or three times the width of a typical binocular's field of view. Courtesy AAVSO.



And here's a deeper, magnified comparison-star chart, 3° wide, for when the nova fades further.

Mizar — A Fresh Look at an Old Friend

By: Bob King

You might be tempted to pass up this familiar star for more exotic quarry, but take another look at a multiple star with a most interesting history.

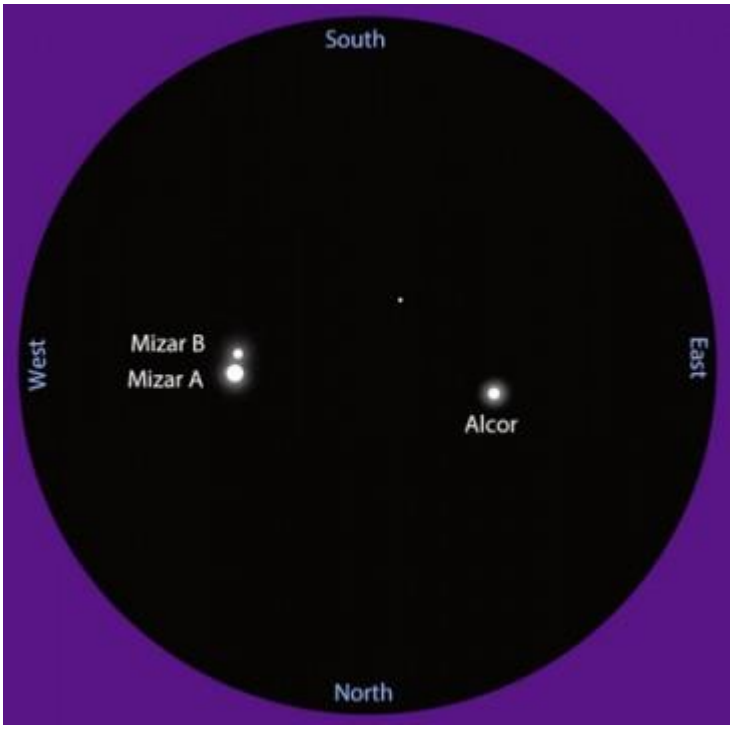
Mizar and its naked-eye companion star Alcor are easily found at the bend of the Dipper's handle.
Stellarium

Mizar, the bright double star in the bend of the Big Dipper's handle, has racked up a few firsts over the years. First double star discovered (1617). First binary photographed in a telescope (1857). First spectroscopic binary (1890). First stellar pair seen by generations of novice star gazers.

From the northern U.S. it's visible all year long, but puts in its best appearance in spring skies, riding the Big Dipper like a rocket to the zenith.

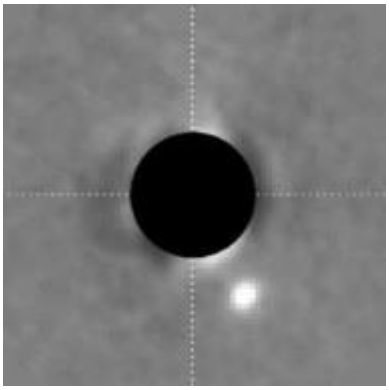
Most people with reasonably good vision can easily spot Mizar's 4th-magnitude companion star, Alcor, 11.8′ to the east. Arabic peoples knew them as the Horse and Rider, a wonderful image which neatly matches their naked-eye appearance.

Through my 4.5-inch reflector at 45x, Mizar is easily one of the prettiest low-power doubles in the sky. Even low magnification cleaves it into two trembling white gems separated by 14” with 2nd-magnitude Mizar A attended by 4th-magnitude Mizar B.



Mizar and companion Alcor in a 4.5-inch (11.4-cm) telescope at 45x. *Bob King*

Both Mizar and Alcor lie about 80 light-years from Earth and share a common proper motion across the sky, yet their great distance from one another made it difficult to determine if they formed a true gravitationally-bound binary star. That issue appears to have been resolved in 2009, when observations made by two independent teams of astronomers not only revealed that Alcor possessed a dim red dwarf companion, but that it was indeed tethered to Mizar. Just barely. The two are separated by 0.5-1.5 light-years.

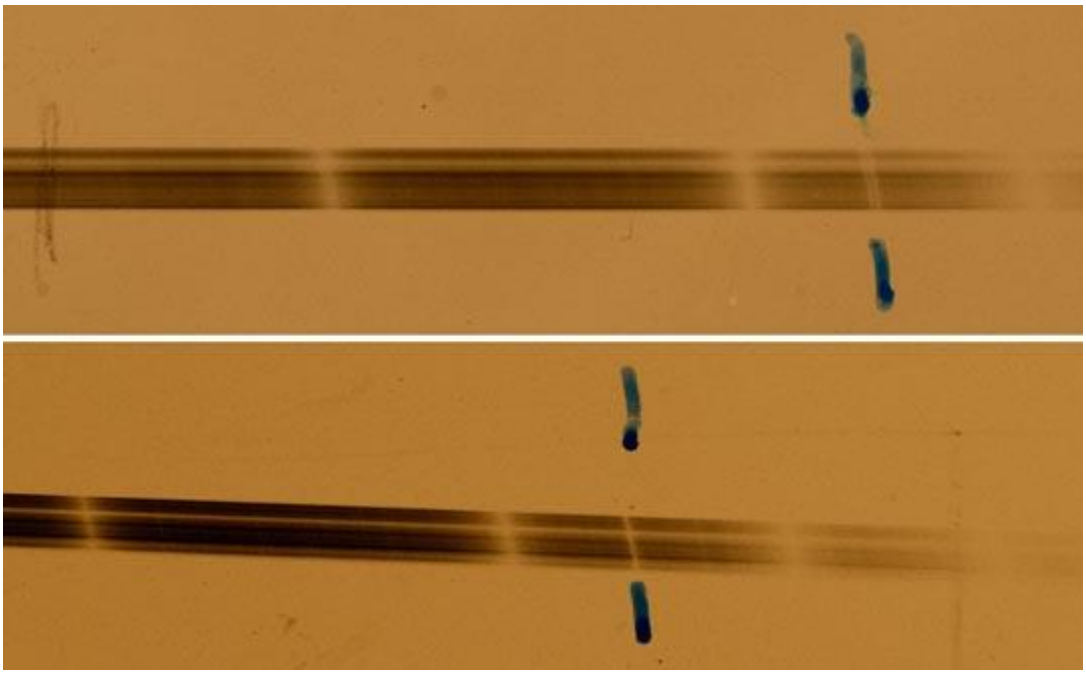


Alcor and its dim red dwarf companion Alcor B. *University of Rochester*

Erik Mamajek, Associate Professor of Physics and Astronomy at the University of Rochester, **discovered Alcor's companion** while looking for extrasolar planets:

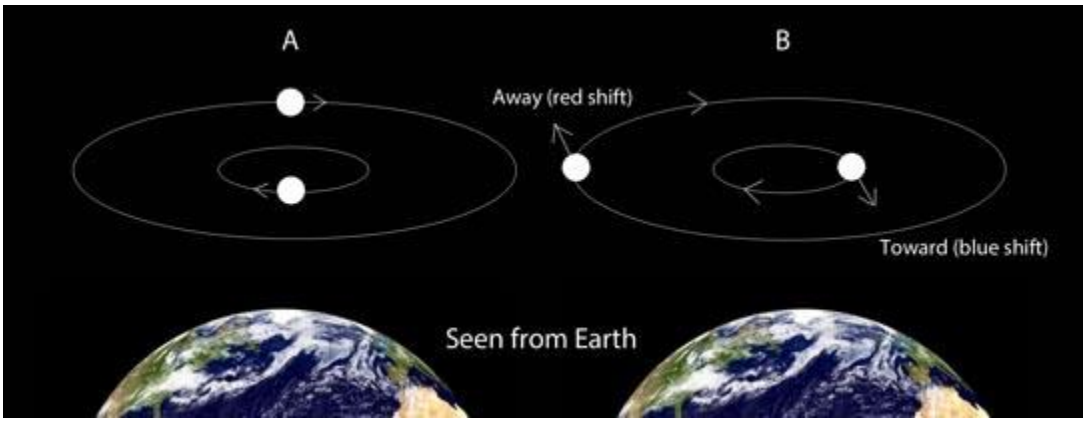
"We were trying a new method of planet hunting and instead of finding a planet orbiting Alcor, we found a star," said Mamjek. But long before Mizar-Alcor was found to be a triple system, the spectroscope forced Mizar to reveal its hand.

American astronomer **Edward Pickering**, who served as director of the Harvard College Observatory from 1877 until his death in 1919, discovered that Mizar A was itself a very close binary star. Too close to split for most telescopes then and now, its duplicity was only revealed by the **spectroscope**.



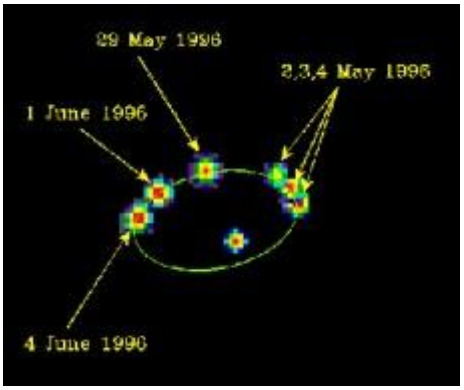
Discovery plate of the first known spectroscopic binary, Zeta Ursa Majoris, better known as Mizar. Top plate taken on Mar 29, 1887; bottom taken Apr 5, 1887. E.C. Pickering noted that the K line of ionized calcium was double on the earlier plate but single later. In time he concluded that Mizar A was a binary system.
Harvard College Observatory

Pickering examined spectra taken of the star, noting that the K line of ionized calcium was double on one date but single on a later date. In a spectroscopic binary, two stars orbit their common center of mass just like the rest of the double clan, but because they're too close to split, they appear as a single point of light.



In A, the two stars that make up Mizar A are moving perpendicular to our line of sight and show no Doppler shift. Spectral lines appear single. In B, the two stars are now moving in opposite directions from Earth. The difference in their Doppler shifts — one red, the other blue — causes their merged lines to separate into pairs, one for each star, revealing two stars where only one can be seen in a telescope. *Bob King*

When the two stars lie *across* our line of sight, their spectral lines overlap and we see a series of *single* dark lines. A few days later, the stars are moving toward and away from us *along* our line of sight. Light from the star moving toward us is shifted toward the blue end of the spectrum, while light from the star moving away is shifted toward the red. The difference in speeds separates the overlapping lines into pairs of lines, one set for each star.



The two components of Mizar A are both nearly identically-sized spectral class A stars. This image was made in the mid-1990s with an optical interferometer capable of extremely high resolution.
J. Benson et al., NPOI Group, USNO, NRL

That was 1890. In 1908, further spectroscopy showed Mizar B to also be a close pair of orbiting stars, making the system fully sextuple!

The two components of Mizar A, separated by just 7 or 8 thousands of an arcsecond, are both about 35 times as bright as the Sun and revolve around each other once every 20.5 days.

The Mizar B pair is comprised of two slightly cooler and fainter A class stars each about 1.6 times as massive as the Sun. While it might seem that the Mizar B and Mizar A pairs must be far apart to split them so easily in a small telescope, the gap between them is only as wide as 8 times Pluto's distance from the Sun (30 billion miles).

Model of the Mizar system (not to scale!) showing each of the three pairs that compose the sextuple. All are main sequence A-class stars similar to Vega or Altair except for Alcor's red dwarf companion. Bob King

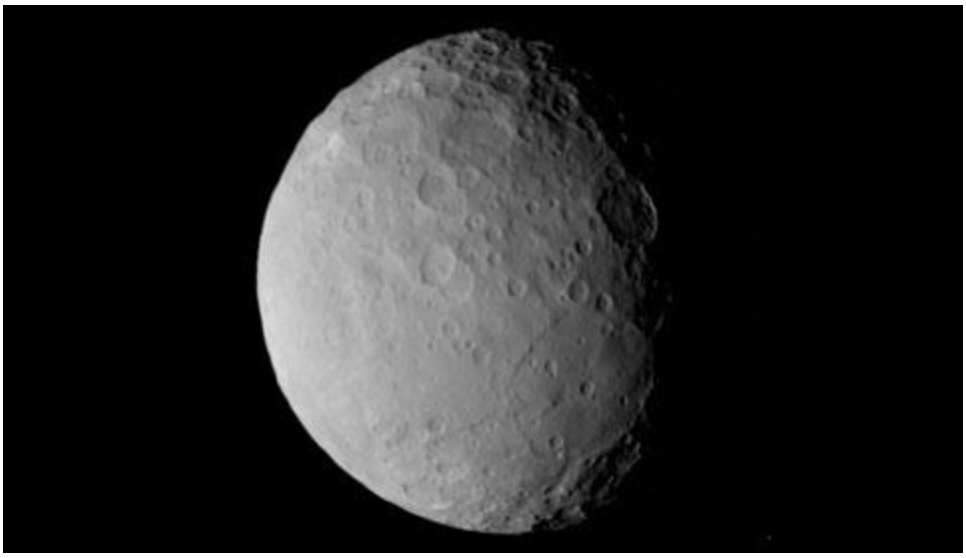
No new companions have been discovered since 2009, but Mamajek hasn't given up on planet hunting around Alcor. He points out that Alcor's disk isn't perfectly round. Does a planet or perhaps another star hide in its glare? Do I hear septuple?

Dawn Orbiter Reaches Dwarf-Planet Ceres

By: Kelly Beatty

The long-distance traveler has finally arrived at the first dwarf planet (and largest asteroid) yet studied by spacecraft.

If the best things in life are worth waiting for, then it's been totally worth it for the team of scientists and engineers involved in NASA's Dawn mission. After a 7½-year journey that covered 3.1 billion miles (4.9 billion km), the spacecraft has finally settled into orbit around its second and final destination: the giant asteroid 1 Ceres.



Images from NASA's Dawn spacecraft reveal a feature reminiscent of a sand dollar on the surface of Ceres, the largest asteroid in the main belt. *NASA / JPL-Caltech / UCLA / MPS / DLR / IDA*

The orbital capture occurred today at 4:39 a.m. Pacific Standard Time (12:39 Universal Time), with the spacecraft about 38,000 miles (61,000 km) from Ceres and out of contact with Earth.

Mission flight controllers at NASA's Jet Propulsion Laboratory received telemetry from Dawn about an hour later, confirming that the spacecraft was healthy and its ion thruster firing as planned. This thruster, which expels a steady stream of xenon ions at roughly 25 miles per second, has provided the gentle, continuous thrust that propelled Dawn first to asteroid 4 Vesta and now to Ceres. (Here's a fun video showing how the engine operates.)

This is a relatively small spacecraft, roughly the size of a golf cart, with a mass of 1,647 pounds (747 kg). At launch it was packed with an additional 937 pounds (425 kg) of xenon for its thruster — that's not much fuel, considering that since leaving Earth the spacecraft's velocity has been throttled up and down by a cumulative 24,000 miles per hour. The thruster is powered by a pair of huge solar-cell panels that stretch some 60 feet (nearly 20 m) across.

On March 1, 2015, just 5 days before entering orbit around Ceres, NASA's Dawn spacecraft captured its destination as a crescent. At the time the two were separated by about distance of about 30,000 miles (48,000 km) . *NASA / JPL / UCLA / MPS / DLR / IDA*

Although Dawn has been recording images of Ceres for weeks, some of which show provocative features, the real science at Ceres won't begin for a while. The thruster will lower and circularize the initial orbit until, next month, the spacecraft will start to characterize all of Ceres from an altitude of 8,400 miles (13,500 km). Then Dawn will be lowered to 920 miles (1,480 km) by August, where it remains in this high-altitude mapping orbit (HAMO) for two months. The spacecraft's German-built framing camera and Italian-built visible-infrared mapping spectrometer will be very busy during this phase of the mission.

Another long firing of the ion thruster will then nudge Dawn even closer, bottoming out at an altitude of about 230 miles (375 km) by no later than mid-December. From this low-altitude mapping orbit (LAMO), Dawn’s gamma-ray and neutron detector (GRaND) has a chance to map elemental abundances around the globe. Moreover, careful tracking of the spacecraft's motion should reveal subtle perturbations that are used to map the body's gravity field and internal structure. Scientists believe that Ceres consists of a rock-and-metal core surrounded by a thick mantle of water ice, with water constituting perhaps 25% of the body's mass.

In fact, planetary scientists expect that Ceres has much to teach them about the formation of the asteroid belt and the solar system in general. Ceres is a very different body than Vesta, Dawn's first target. For one thing, it's 590 miles (950 km) across — nearly twice Vesta's diameter and large enough to qualify as a dwarf planet. There's some suspicion that it never got warm enough to completely *differentiate* (separate) into discrete layers of rock and ice, but Ceres likely had some form of subsurface ocean early in its 4½-billion-year history.

"We have much to do over the next year and a half," notes principal investigator Chris Russell (UCLA) in a NASA press release, "but we are now on station with ample reserves, and a robust plan to obtain our science objectives."

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