Southwest Florida Astronomical Society
SWFAS

The Eyepiece
June 2014

Contents:

A MESSAGE FROM THE PRESIDENT

Summer is fast approaching, so are our summer rains.

Right now we still can check out three of our brightest planets in the evening sky.

In May we had several events, the Skyline Elementary observing night was a great success. Weather was perfect and everyone had a great time. Carol and I would like to thank those that came out, Tony Heiner, Doug Heatherly, Gary McFall and Johnnie Royal. Astronomy Day the next day at the planetarium was a great success too. Doug, Bruce Dissette, Tony and Gary came out to help Carol and me.

While at Skyline, I was given a surprise package from Jordan Blessing. I had asked about some bolt cases he was selling as I know the club members are interested in obtaining some. He gave us a large number of 2" cases and a variety of other sizes. These will be available to club members, we are going to let them go at $1.50 each as a fundraiser for equipment. (He has more for sale at this price if we run out.)
The new meteor shower on the 24th fizzled. I heard from Mark Kelly, Carol Stewart and a few others who saw none or one from it.

There is a Caloosahatchee Regional Park Star Party on May 31st. We also have another scheduled for June 28th. (If the park gets closed this summer , we will look into moving the parties to the Seahawk Park in North Cape Coral.)

On July 19th, Cape Coral Parks and Rec will have their annual Parks and Recreation Day at the Yacht Club from 10am to 1pm. We will be setting up for solar observing and doing handouts.

We are looking at obtaining a small goto mount that we can use with the PST for outreach events that will support easy setup and the ability to use it without having it tied to one of the C-8's. This will be discussed at the meeting and may become the goal of fundraising and the selling of equipment I still have from the PST event.

I went down to the Hyatt Regency Coconut Point to help them get familiar with their new telescope, a CPC 1100 Edge. This is a very nice scope! I will be prepping them some setup and operation literature and general astronomy info for their staff.

For the program this month, I will be giving a talk about solar observing equipment and methods as well as what one can see.
Brian

In the Sky this Month

Moon: June – 1st Quarter 5th; Full 13th; Last Quarter 19th; New 27th.
July – 1st Quarter 5th; Full 12th; Last Quarter 18th; New 26th.

The Planets

Jupiter will fade lower into the western sky this month with a reduced, but still impressive, -1.8 magnitude. It aligns with Castor and Pollux near month's end.
Mercury begins the month far to the lower right of Jupiter, but disappears in a few days.
Mars begins the month at -0.5 magnitude high in the western sky. It is moving rapidly eastward towards Spica. Towards the end of the month, it will have dimmed to 0.0 magnitude.
Saturn is looking good all month, starting at a magnitude of 0.2, dimming to 0.4 by month's end. It is retrograding towards the double star, α Librae (Zubenelgenubi).
Venus still shines at magnitude -3.9 at dawn.
Uranus and Neptune are both visible before dawn. Finder charts can be found at **skypub.com/urnep**.

The International Space Station: There are several good viewing opportunities this month.
June 1st at 9:48 pm from SW to NE; max alt 75°; for 4 minutes at - 3.5 mag.
June 2nd at 8:59 pm from SSW to ENE; max alt 32°; for 6 minutes at - 2.6 mag.
June 3rd at 9:46 pm from WSW to NNE; max alt 27°; for 6 minutes at - 1.0 mag.
June 4th at 8:56 pm from SW to NE; max alt 59°; for 6 minutes at - 3.4 mag.
June 6th at 8:55 pm from W to N; max alt 18°; for 4 minutes at - 0.1 mag.
June 22nd at 10:12 pm from NNW to NNE; max alt 51°; for 3 minutes at - 2.7 mag.
June 23rd at 9:22 pm from NNW to E; max alt 26°; for 4 minutes at - 1.8 mag.
June 24th at 10:08 pm from WNW to SW; max alt 35°; for 3 minutes at - 2.2 mag.

June 25th at 9:17 pm from NW to SE; max alt 86°; for 6 minutes at - 3.3 mag.
June 27th at 9:14 pm from WNW to S; max alt 22°; for 5 minutes at - 1.2 mag.
Extracted from http://www.heavens-above.com/

Hubble Space Telescope: Several viewing opportunities available early in the month, but need darker skies than for ISS viewing.
June 5th at 9:14 pm from W to E; max alt 70°; for 8 minutes at 1.0 mag.
June 6th at 9:07 pm from W to E; max alt 67°; for 8 minutes at 1.1 mag.
June 7th at 9:00 pm from W to E; max alt 67°; for 8 minutes at 1.1 mag.
June 8th at 8:54 pm from W to E; max alt 70°; for 8 minutes at 1.0 mag.
June 9th at 8:47 pm from W to E; max alt 76°; for 8 minutes at 0.9 mag.
June 10th at 8:40 pm from W to E; max alt 86°; for 8 minutes at 0.9 mag.
June 11th at 10:15 pm from W to SW; max alt 27°; for 3 minutes at 2.2 mag.
June 12th at 10:09 pm from WSW to SSW; max alt 21°; for 3 minutes at 2.5 mag.
Extracted from http://www.heavens-above.com/

Future Events

Upcoming Meetings

Our June meeting will be held on Thursday June 5th at 7:30 pm at the Calusa Nature Center and Planetarium. Our program is Solar Observing Equipment/Methods by Brian.

Star Party and Event Schedule

Date	Event	Location	Time	Info/Contact
May 31st	Star Party	CRP	Dusk	Bruce Dissette
Thursday, June 5th	Monthly Meeting	Calusa Nature Center & Planetarium	7:30 pm	Brian Risley/ Brian Shultis
Wednesday, June 25th	Hurricane preparedness program	Calusa Nature Center & Planetarium	7:00 PM	Lee County Emergency Operations Center
June 28th	Star Party	CRP	Dusk	Bruce Dissette
Sat July 19th	Cape Coral Parks and Rec Day	Cape Coral Yacht Club	10am-1pm	Brian Risley / Katie Locklin
July 26th	Star Party	CRP	Dusk	Bruce Dissette
August 23rd	Star Party	CRP	Dusk	Bruce Dissette
Sept. 27th	Star Party	CRP	Dusk	Bruce Dissette
October 25th	Star Party	CRP	Dusk	Bruce Dissette
November 22nd	Star Party	CRP	Dusk	Bruce Dissette
December 20th	Star Party	CRP	Dusk	Bruce Dissette

Minutes of SWFAS Meeting – May 1, 2014

The May minutes will appear in a future issue.

The Hottest Planet in the Solar System

By Dr. Ethan Siegel

When you think about the four rocky planets in our Solar System—Mercury, Venus, Earth and Mars—you probably think about them in that exact order: sorted by their distance from the Sun. It wouldn't surprise you all that much to learn that the surface of Mercury reaches daytime temperatures of up to 800 °F (430 °C), while the surface of Mars never gets hotter than 70 °F (20 °C) during summer at the equator. On both of these worlds, however, temperatures plummet rapidly during the night; Mercury reaches lows of -280 °F (-173 °C) while Mars, despite having a day comparable to Earth's in length, will have a summer's night at the equator freeze to temperatures of -100 °F (-73 °C).

Those temperature extremes from day-to-night don't happen so severely here on Earth, thanks to our atmosphere that's some 140 times thicker than that of Mars. Our average surface temperature is 57 °F (14 °C), and day-to-night temperature swings are only tens of degrees. But if our world were completely airless, like Mercury, we'd have day-to-night temperature swings that were *hundreds* of degrees. Additionally, our average surface temperature would be significantly colder, at around 0 °F (-18 °C), as our atmosphere functions like a blanket: trapping a portion of the heat radiated by our planet and making the entire atmosphere more uniform in temperature.

But it's the *second* planet from the Sun -- Venus -- that puts the rest of the rocky planets' atmospheres to shame. With an atmosphere **93 times as thick as Earth's**, made up almost entirely of carbon dioxide, Venus is the ultimate planetary greenhouse, letting sunlight in but hanging onto that heat with incredible effectiveness. Despite being nearly twice as far away from the Sun as Mercury, and hence only receiving 29% the sunlight-per-unit-area, the surface of Venus is a toasty 864 °F (462 °C), with *no difference* between day-and-night temperatures! Even though Venus takes hundreds of Earth days to rotate, its winds circumnavigate the entire planet every four days (with speeds of 220 mph / 360 kph), making day-and-night temperature differences irrelevant.

Catch the hottest planet in our Solar System all spring-and-summer long in the pre-dawn skies, as it waxes towards its full phase, moving away from the Earth and towards the opposite side of the Sun, which it will finally slip behind in November. A little atmospheric greenhouse effect seems to be exactly what we need here on Earth, but as much as Venus? No thanks!

Check out these "10 Need-to-Know Things About Venus":

http://solarsystem.nasa.gov/planets/profile.cfm?Object=Venus.

Kids can learn more about the crazy weather on Venus and other places in the Solar System at NASA's Space Place: http://spaceplace.nasa.gov/planet-weather.

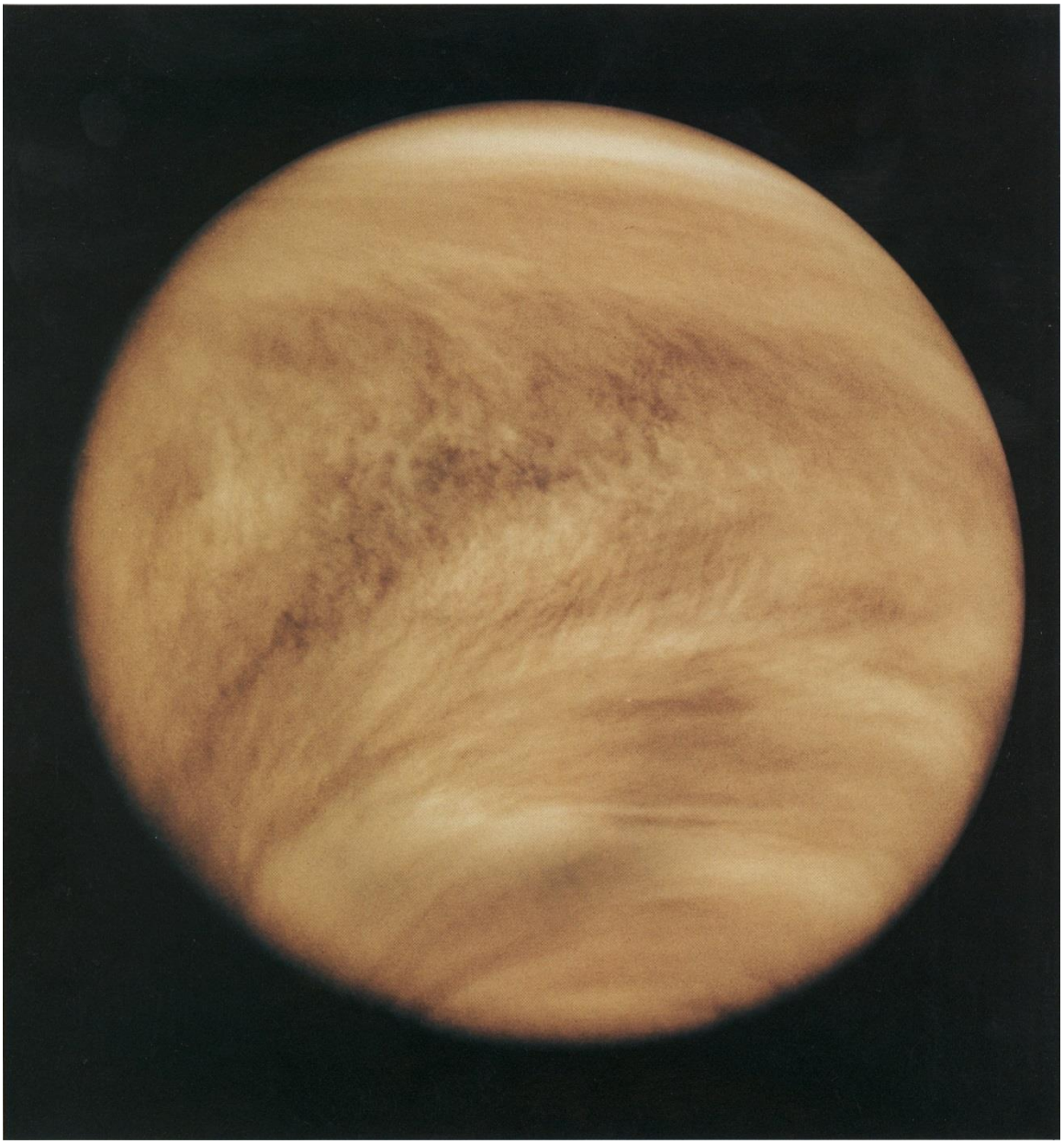
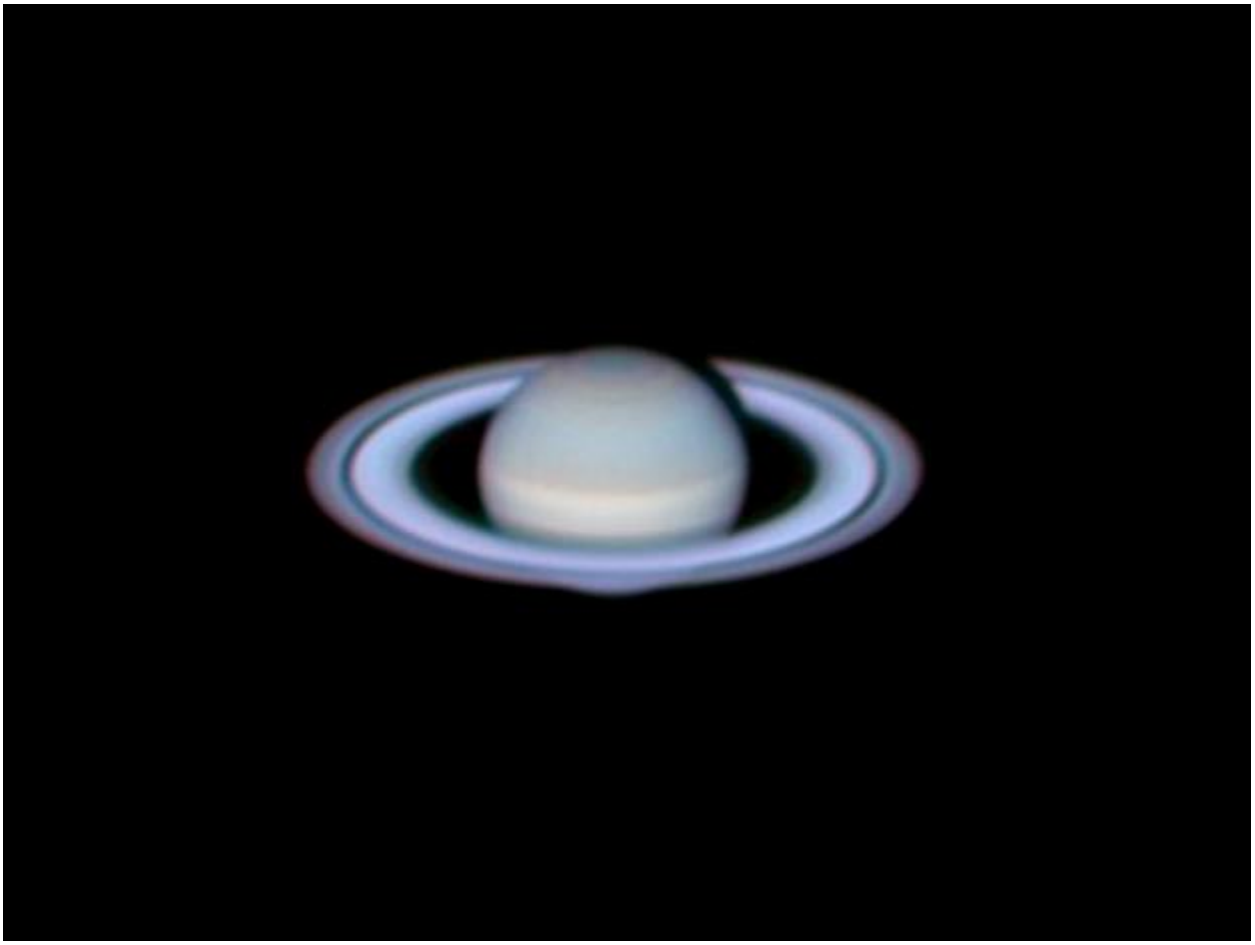


Image credit: NASA's Pioneer Venus Orbiter image of Venus's upper-atmosphere clouds as seen in the ultraviolet, 1979.

Observing Saturn: Everything You Need to Know

by Tammy Plotner - a professional astronomy author, President Emeritus of Warren Rupp Observatory and retired Astronomical League Executive Secretary. She's received a vast number of astronomy achievement and observing awards, including the Great Lakes Astronomy Achievement Award, RG Wright Service Award and the first woman astronomer to achieve Comet Hunter's Gold Status.

It's Saturn season! Right now is the best time of year to visit with the enigmatic planet Saturn and talk about what makes it so special. Whenever you are ready, let's find a relatively dark sky site and head out!



Saturn, by Cherdphong Visarathanonth in Bangkok, Thailand. Taken using an Orion SkyQuest XT8g Computerized GoTo Dobsonian Telescope.

During the 2014 Saturn season, the famous planet can be found in the constellation of **Libra**. However, this particular constellation isn't exactly easy to identify. For those new to astronomy, the best way to find Saturn is to locate the bright red star Antares, and brilliant blue-white star Spica. You'll find Saturn almost halfway between this conspicuous pair. If you allow your eyes plenty of time to adapt to the dark, you'll notice Saturn is creamy yellow and doesn't twinkle like its stellar counterparts. There is good

reason for that. Planets are not only far closer than the stars, but the light you see from them is reflected; not generated.

Once you have located Saturn with just your eyes, stop and think about some very cool Saturn facts: Saturn is the second largest planet in our solar system and it was recorded as far back as 700 B.C. by the Assyrians, a group of people who once lived near modern-day Iraq. They called it the Star of Ninib, but the name Saturn comes from the Roman god of farming. This year, Saturn's rings are on full display, tilted towards our line of sight by about 22 degrees, and well on their way to a maximum tilt of 27 degrees in 2016.

Saturn will be at opposition on May 10. During opposition, the planet will rise directly opposite the Sun in the sky. However, there is more to this special date, because Saturn will also be the closest to Earth. Just how close is close? Let's try far. If you were to travel to Saturn by car at a speed of 70 mph and took no breaks, it would take 1,595 years to get there when Saturn is at its farthest point away from us. That's a mighty long time to go without stopping at for a snack or using the restroom!

Saturn's position in the sky on the night of opposition.

Now, let's take a look at Saturn through binoculars and talk about it. If you can hold your binoculars very steady, you'll see an orb that is slightly stretched. This is very much like what Galileo Galilei saw in 1610. He thought the rings looked like "ears" and were "handles" or moons. In a secret anagram to his scientist friend, Johannes Kepler, Galileo wrote he had discovered that the "highest planet" was "triple-bodied."

Now we know what he was seeing was Saturn's famous ring system. While the planet itself is mainly composed of helium gas, the rings are made up of dust, ice and chunks

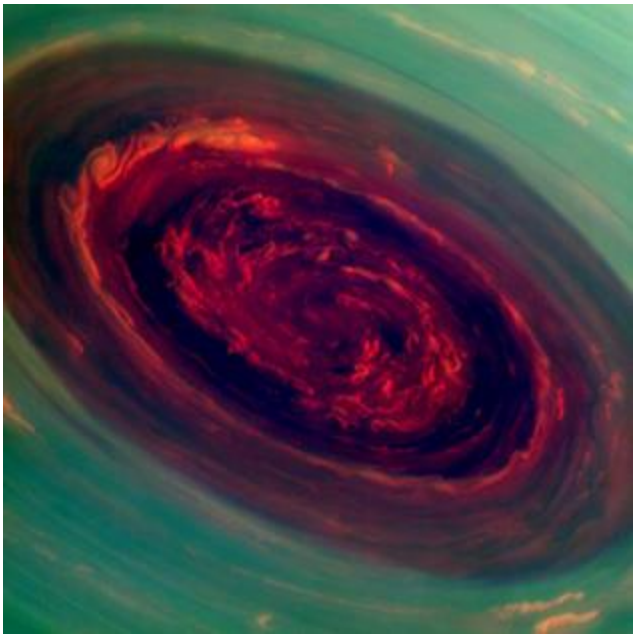
of rock. These might be as small as a grain of sand, or as large as a house! The ring system is large, stretching across a distance which measures about halfway between the Earth and Moon. Although it might be wide, it's not very deep, and astronomers estimate the rings to be just a few hundred feet thick.

Are you ready to look at Saturn through a small telescope now? Small refractors easily reveal the planet's rings. In telescopes as small as 4.5", you'll begin to see a great many more details, such as Saturn's flattened shape. Yes, the rings are not the only thing that's flattened: Saturn rotates incredibly fast at 6,200 mph, causing the planet to bulge at its equator and its poles to flatten. If Saturn is spinning that fast, it should mean shorter "days," right? You bet. A day on Earth is 24 hours and a day on Saturn is 10 hours and 39 minutes.

Keep looking through your small scope, because you'll also see that Saturn has visitors. When the seeing is good, you can easily spot Saturn's largest moon, **Titan**, well away from the planet body - about two planet widths. However, look closely at the edge of the ring system over the nights and you stand a very good chance at spotting at least four more moons - **Tethys, Rhea, Dione** and **Enceladus**. They appear at different orbital positions at different times. Using computer software like "Starry Nights" can help you determine which ones you may have observed. Saturn's moon Titan is the second-largest moon in the solar system, and it is the only known moon to have a substantial atmosphere, which is 370 miles deep, 10 times thicker than Earth's atmosphere. While it might be quiet to look at, Titan is a really noisy place. Its winds sound much louder because its dense atmosphere intensifies sound waves.

Did someone say windy? Yep. It's windy on Saturn, too. Winds in Saturn's atmosphere travel up to 1,100 mph. That's almost four times faster than the strongest tornadoes on Earth!

As your telescope size increases, so does the resolution. This means you'll start to see differences in the planet's body coloration, which indicate storms. Sometimes, Saturn can have some very wild storms that can last for weeks, or even years! In 2004, a storm on Saturn named the "Dragon Storm," created mega-lightning 1,000 times more powerful than lightning on Earth. According to a national press release, in early 2010, amateur astronomers spotted a massive ammonia blizzard raging on Saturn. The monster storm is five times larger than "Snowmageddon," the snowstorm that shut down Washington D.C. in February 2010. Just think - that means observers like you and me can often spot things that professional observatories might miss!



False-color image of the spinning vortex of Saturn's north polar storm, from NASA's Cassini spacecraft.

Are you ready to observe Saturn with a large telescope now? Then let's talk about what you might see. When conditions are steady and you're able to use a lot of magnification, you can see many divisions in the ring system. They'll look very similar to an old-fashioned record album. Saturn has seven main rings that consist of thousands of smaller rings. The ring farthest from the planet, the E ring, is about 180,000 miles across. In contrast, the F ring is about 20-300 miles wide. One of the easiest to see (even with small scopes) is known as the Cassini Division. It was discovered in 1675 by Giovanni Cassini at the Paris Observatory using a telescope of only 2.5" aperture. Although a whole book can be written about observing Saturn's ring system with a large telescope, there are two very unique things to look for. The first is fairly easy: spying the body of Saturn through the Cassini Division. The second is transient and far more difficult. It is called "spoking. " It is a rare occurrence, but not an impossible one. It looks like bolts of lightning captured in the ring plane - like spokes on a wheel. It has been this author's great privilege to have seen spoking in person using a 32" telescope, so it is a reality.

All in all, 2014 should be an interesting year to observe Saturn. On the 14th of May, just four nights after opposition, Saturn and the Moon will be less than a degree apart. If you're clouded out, try looking again on July 8th when the pair is about a degree and a half apart. If you're interested in unusual pairings, try observing on the nights of September 11-13th when it cruises the ecliptic plane accompanied by asteroid Vesta about 1 to 2 degrees away. And if you're looking for a fun sight to point out to family and friends, check out Saturn on the night of August 31st, when the yellow giant will be triangulating with Mars and the Moon a scant four degrees apart. Now, that's a Kodak moment!

Tips for the Best Views:

When it comes to viewing Saturn, viewing conditions are a key requirement. No matter what size optical equipment you use, the steadiness of the sky plays a major role in the amount of details you can see. Looking at Saturn in an unstable sky would almost be like looking at it under running water? and using high magnification during bad seeing only magnifies the bad seeing. Using a yellow filter can assist in revealing some details, but isn't necessary to have a good viewing session. It never hurts to try a variety of filters, but remember they dim the image, especially with a smaller scope.

Try using my three "Ps" of amateur astronomy: Patience, Practice and Persistence. Have patience when you are viewing Saturn. Bad skies can sometimes only be bad moments, and by patiently viewing for an extended period of time, you will be rewarded with the one moment that takes your breath away with its clarity. Practice is mandatory. You'll never see intricate details unless you practice seeing them. Try your hand at sketching while at the eyepiece. This practice allows you to open your mind to what you can see by focusing your attention on smaller areas. Last of all is persistence. Keep at it. If you don't see something on one night - you just might see it on another. And discover why Saturn is the real "Lord of the Rings"! *Thanks to Mike Romine for the inspiration!*

Star Cluster Runs Away From Home

By: Monica Young | May 15, 2014

A hive of stars is sailing toward Earth at more than 2 million miles per hour — and racing away from the giant galaxy it used to call home.

M87 is a giant elliptical galaxy with a 4-billion-solar-mass black hole in its center, which produces a powerful jet (blue). If that supermassive black hole is actually a binary, that

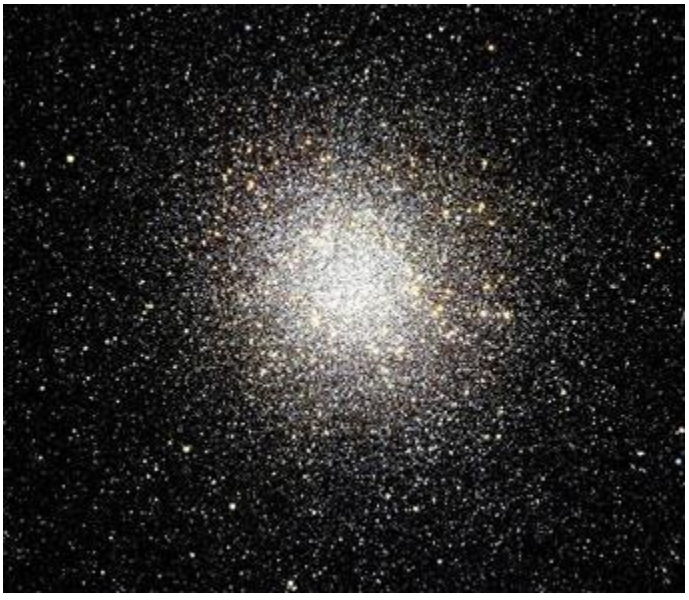
may explain the escape of the star cluster HVGC-1. *NASA / ESA / the Hubble Heritage Team*

Relics of a galaxy's ancient past, the stellar cities known as globular clusters are among the first collections of stars to form. Hundreds of thousands of them pack into spherical hives a couple dozen light-years across. These clusters are generally happy to orbit their host for billions of years, their trajectories taking them on million-year orbits through the galaxy's sparse halo.

But one globular appears to be living life on the wild side. Of the several thousand orbiting the giant elliptical galaxy M87, the cluster dubbed HVGC-1 (for *hypervelocity globular cluster*) is screaming toward us at more than 2 million miles per hour (1,025 km/sec).

Nelson Caldwell (Harvard-Smithsonian Center for Astrophysics) and colleagues were going about their business exploring the globulars around M87 when they discovered the errant cluster. While the Milky Way plays host to 150 globular clusters, M87's massive gravitational well contains several thousand. The observing campaign had already netted 500 new clusters over the course of several years, plus another 2,500 candidates that will be published shortly.

Many of those candidates are run-of-the-mill globular clusters in orbit around M87, with a sprinkling of foreground stars and background galaxies in the mix. But one object wasn't any of the above. Its color and spectral lines clearly identify it as a globular cluster, but its velocity is so extreme that it must be escaping not just the galaxy, but the entire Virgo Cluster of galaxies in which M87 sits.



One of the brightest globular clusters visible in the night sky, M22 is about 50 light-years in radius. This is the upper limit on the size measured for the newly discovered globular HVGC-1. *Jean-Charles Cuillandre (CFHT), Hawaiian Starlight, CFHT*

Nothing like it has ever been seen before. Individual *stars* have been seen exiting a galaxy at high speeds and are called *hypervelocity stars* for obvious reasons. Astronomers think these stars are ejected when a binary star system makes a close encounter with a galaxy's supermassive black hole. About 20 stars have been kicked out of the Milky Way and into intergalactic space.

"The hypervelocity cluster and hypervelocity stars are completely unrelated, however," says Warren Brown (also at the Center for Astrophysics, but not associated with the study). "The hypervelocity cluster is a remarkable discovery because there is no good explanation for it."

Drawing a parallel with hypervelocity stars doesn't work, because it is unlikely that globular clusters come in binaries, as stars do. Even if that were possible, the two clusters should merge into one before getting a chance to interact with anything. Nor does a lone globular cluster interacting with a dark matter clump in the galaxy's halo seem promising. The three-body interaction between cluster, clump, and galaxy could eject the cluster, but not at the extreme speeds that Caldwell's team is seeing.

The most likely alternative, the authors say, is that M87 actually has a double supermassive black hole. There is evidence for this, though it's circumstantial: the supermassive black hole we see (by the light of the hot gas that feeds the beast) is offset from the galaxy's center very slightly, so it may be undergoing a merger that's causing it to spiral around the galactic center. The orbits of M87's globular clusters support the idea of a recent merger with another sizable galaxy. If the supermassive black hole in M87 is not one, but two, then a three-body interaction could have slingshotted HVGC-1 out of the system.

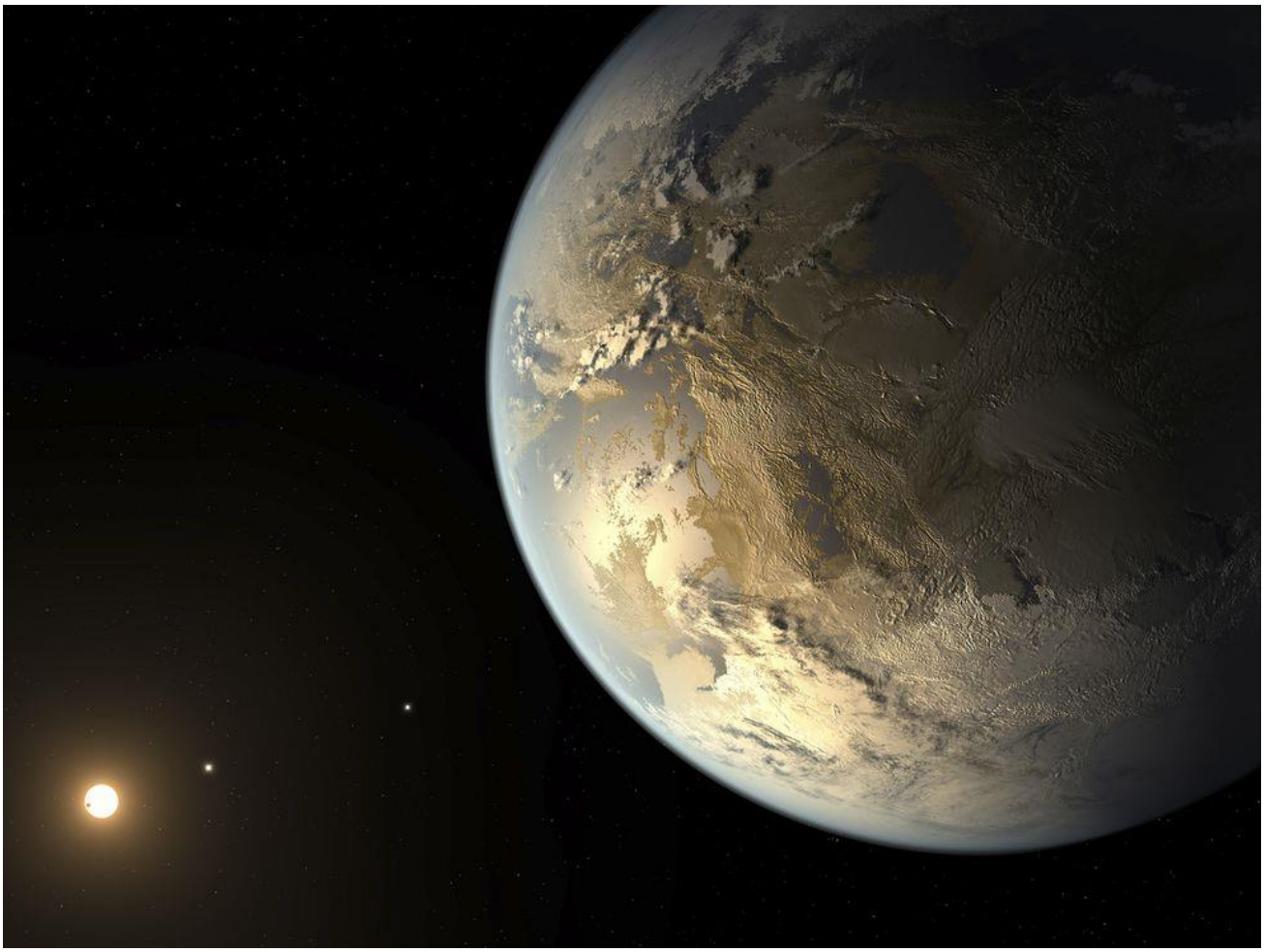
Here's the rub. While three-body interactions are the best way to eject something so massive into space, globular clusters (unlike stars) are extended objects and that makes any three-body ejection difficult, Brown explains.

"The extreme velocity is very hard to explain," he says, but then again, that's half the fun. "This discovery is exciting because it forces us to figure out how our universe works."

- See more at: http://www.skyandtelescope.com/astronomy-news/star-cluster-runs-away-home/#sthash.G4weZ4fz.dpuf

Kepler Telescope Discovers Most Earth-Like Planet Yet

A nearly Earth-size planet orbits in a star's habitable zone, detected by NASA astronomers.

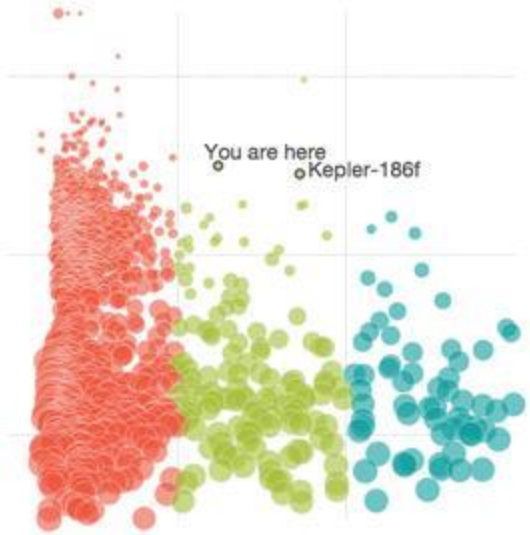


This artist's depiction shows Kepler-186f, an Earth-size world in the "habitable zone" of a red dwarf star. ILLUSTRATION BY NASA/JPL-Caltech/T. PYLE

Dan Vergano National Geographic Published April 17, 2014

Red sunshine, seas, and maybe aliens? Scientists analyzing data from NASA's Kepler Space Telescope today report the closest thing yet to another Earth, a world in a habitable orbit around a red dwarf star some 493 light-years away.

Launched in 2009 with the goal of finding another Earth, the $600-million Kepler spacecraft has discovered more than 960 planets orbiting nearby stars. Half a dozen of those seem to be rocky, like Earth, and have orbits in the habitable zone around their star—but the newly discovered world, named Kepler-186f, is the closest in size to Earth.



See interactive: Hundreds of Exoplanets, a Handful Right for Life

"This is a first, validated Earth-size planet in the habitable zone of another star," says study lead author Elisa Quintana of the SETI Institute and NASA's Ames Research Center in Mountain View, California. The discovery of the planet was reported today in the journal Science and in a space agency press briefing. (Related: "Motherlode of Alien Worlds Revealed by Space Telescope.")

One of five planets orbiting a red dwarf star (called Kepler 186), Kepler-186f is 1.1 times wider than Earth. That means it's almost certainly a rocky planet too. The researchers estimate its mass is 1.5 times that of Earth's.

The new planet's orbit, meanwhile, places it at the "Goldilocks" distance from its star—not too hot or too cold for liquid water to exist on its surface. The origin of life on Earth required liquid water, notes study co-author Stephen Kane of San Francisco State University.

"This is an historic discovery—the first Earth-size planet found in the habitable zone around its star," says pioneering planet hunter Geoff Marcy of the University of California, Berkeley, who was not on the discovery team. "This is the best case for a habitable planet yet found."

The planet's red dwarf star is only about half as big as the sun, making it cooler and dimmer. But Kepler-186f is on a tighter orbit than Earth is, taking only 130 days to circle its star. Though it receives less warmth from its sun than Earth does from its own, the discovery team says, it would still be warm enough to prevent seas from freezing—provided it has an atmosphere that provides a substantial greenhouse effect.

"This planet basks in an orange-red glow from that star, much as we enjoy at sunset," Marcy says, by email. "The temperature on the planet is likely cool, similar to dawn or dusk on a spring day."

Crowded Claims

"Sounds like a great planet to visit, if we could figure out how to travel there," says MIT astronomer Sarah Seager, by email. But amid the excitement, she and planetary scientist Alan Boss, author of *The Crowded Universe: The Search for Living Planets*, caution that other discoveries have led to similar claims in recent years.

Since 1995, astronomers have detected nearly 1,700 worlds orbiting nearby stars, using a variety of detection methods. About a half dozen claims of bigger Earth-size (or still larger "super-Earth") planets orbiting in habitable zones around red dwarfs have been made in recent years, Boss says. "Still, it once again proves what Kepler can do."

The next closest thing to Kepler-186f has a width 1.4 times that of Earth, Quintana says. According to Seager, a planet whose diameter is less than 1.75 Earths is likely to be rocky.

The Kepler report looks particularly reliable because of the spacecraft's track record. It detects planets that dim the light from their stars as they pass in front of them. Such transits, Quintana says, are observable only in the roughly one percent of planetary systems whose orbits can be seen edge on from Earth.

When transits occur regularly, their frequency allows scientists to calculate the distance at which a planet is orbiting a star. The amount of starlight dimming—typically on the order of 0.1 percent—is a measure of the planet's size.

Such searches are most sensitive to closer-in stars, because fewer days of observations are required to see repeated transits. That explains why the newly discovered planet's four closer-in siblings had been spotted earlier by the space telescope. "They relied on only two years of data," Quintana says. With so many planets in the system, it's likely to be stable over billions of years.

Tickets on Hold

Whether a life-friendly atmosphere exists on Kepler-186f depends on a bevy of factors besides having the right orbit. "We see planets in our own solar system—Venus but also Mars—that are Earthlike but where things didn't work out," Kane says.

On Venus, a runaway greenhouse climate has cooked the surface to temperatures that would melt lead. On Mars, the lack of a strong magnetic field has allowed the solar wind to strip away much of the planet's atmosphere. A magnetic field would be particularly important for a planet orbiting a red dwarf, because such stars tend to release strong flares that would sterilize the planet.

"Just because a planet is in the habitable zone doesn't mean it is habitable," Quintana says. "This is sort of a first step."

However, Kane argues that the greater mass of Kepler-186f makes it more likely than Mars to have an interior heated by radioactivity and stirred by the motion of fluids. Such motions are required to power a dynamo that generates a protective magnetic field as well as volcanoes, whose eruptions would help replenish a life-friendly atmosphere. The planet's mass would also give it enough gravity to hold on to that atmosphere.

"The other big question is whether it has water, delivered by comets or some other means," Kane says. "Any place with liquid water is a natural place to look for life."

Unfortunately, Kepler-186f is likely too dim and far away to be seen directly with any telescope now in operation, or even with NASA's James Webb Space Telescope, scheduled for launch in 2018.

"In reality we cannot know if the planet is actually habitable. We need to get a sense of the atmosphere and its greenhouse effect," Seager says. "Not possible for this particular planet, as it is too distant from Earth for follow-up observations."

Kepler's Chase

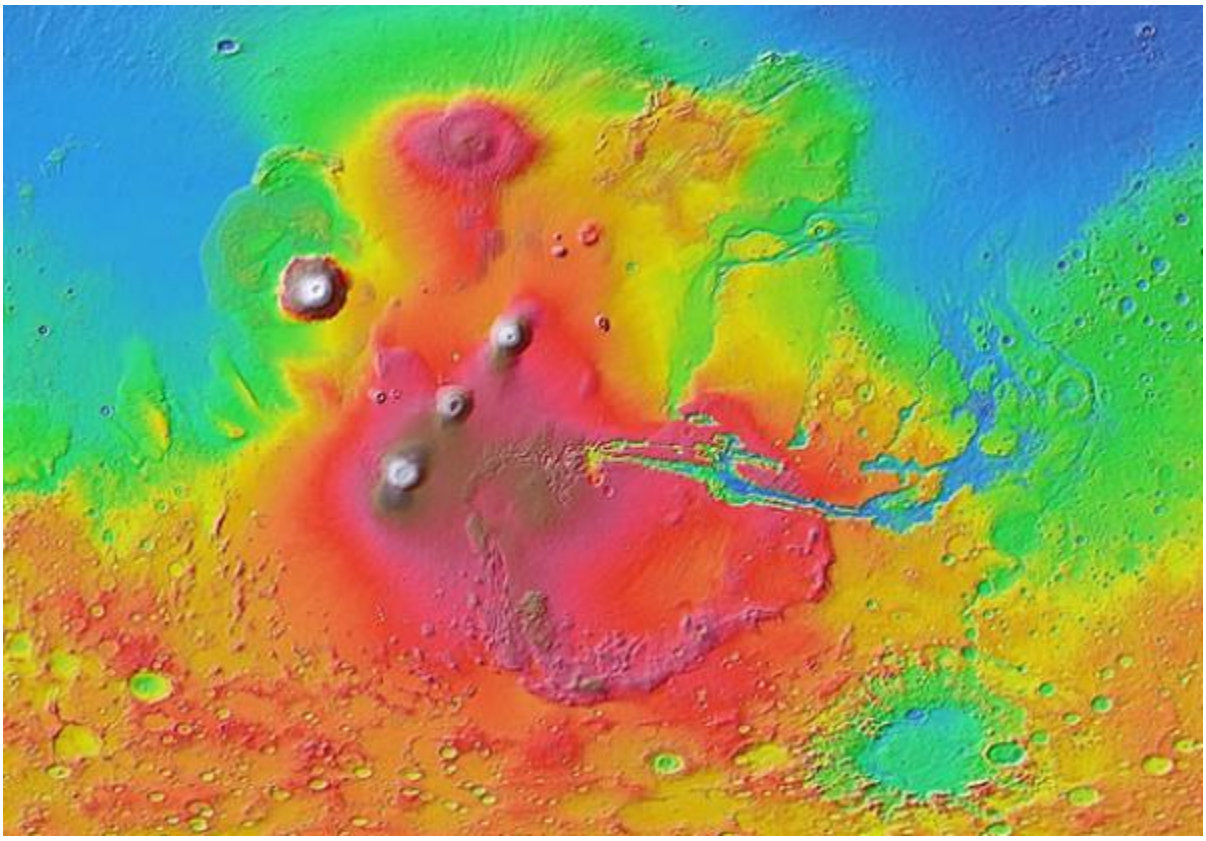
The latest Kepler discovery came from a trove of star observations that the spacecraft made before a reaction wheel in its steering system failed last year, hobbling the mission. A reduced "K2" mission was announced in March.

Hiding amid the existing Kepler observations, Kane says, are more unconfirmed "candidate" planets orbiting stars as big as the sun, at distances similar to Earth's 93-million-mile (150-million-kilometer) distance from the sun.

"There are still a lot more Kepler 'habitable zone' worlds out there to find," Kane says. "Almost certainly this is not the last one."

The Yellowstone of Mars

By Sid Perkins, 9 May 2014 1:45 pm



NASA/JPL-Caltech/Arizona State University

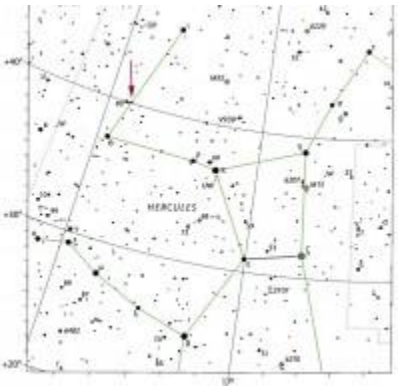
One of Mars's most prominent features is a volcanic province known as the Tharsis bulge, a near-circular, 2000-kilometer-wide hump (center, depicted in shades of red and brown) near the planet's equator that is 10 km high in places. Volcanism there is likely fueled by a plume of hot material welling up from deep within the planet. Problem is, computer simulations and lab studies suggest that such a plume wouldn't develop where the bulge is now—that is, along the relatively sharp boundary between Mars's thinner crust of the northern hemisphere and the much thicker crust beneath the southern highlands. Using measurements of the planet's gravitational field and elevations (ranging from low [blue] to high [white]) taken from orbit, researchers have identified a swath of thicker-than-normal crust that may mark the slow but steady migration of the volcano-fueling hot spot from the planet's south pole (bottom), they will report in a forthcoming *Journal of Geophysical Research: Planets*. Previous studies have noted a lower-than-normal number of craters along that swath—a hint that volcanism may have smothered ancient pockmarks in that region—but the new findings bolster the notion that the hot spot migrated from where studies suggest it should have formed in the first place. Interestingly, the team notes, the overall pattern of terrain in that region of Mars is similar to that in the western United States, where the higher-than-normal topography of Idaho's Snake River betrays the presumed path of the hot spot that drove past

volcanism, as well as current geothermal activity, in and around Yellowstone National Park.

Sun’s Sibling Found

By: John Bochanski | May 13, 2014

Astronomers have confirmed that a star in the constellation Hercules is a dead ringer for one of the Sun’s long-lost brothers.



The star HD 162826 in Hercules potentially was born in the same cluster as the Sun was. This chart is from *S&T*'s *Pocket Sky Atlas*.

Stars like our Sun form in groups. We see evidence for this throughout the Milky Way, most famously in the Trapezium Cluster in the Orion Nebula. But after stars begin to emit their nascent light, their gravitational interactions with other nearby "siblings" send them out from their birth cluster and into the expanses of our galaxy.

Even though they travel thousands of light-years from where they first formed, stars carry the signature of their birthplace in the detailed chemical composition contained in their atmospheres and their motions through space. Astronomers have been searching for the lost siblings of the Sun for some time, and they’ve found several candidates. Now, using these lines of evidence, they think they’ve confirmed one.

Ivan Ramírez (University of Texas, Austin) and his team used high-resolution spectroscopy obtained at the McDonald Observatory in Texas and Las Campanas Observatory in Chile to inspect the atmospheres of 30 suspected solar siblings. (These stars are not true "solar twins," stars that appear similar to the Sun with respect to virtually every observable property — including mass, luminosity, and composition — regardless of origin.) The team chose these 30 stars from previous studies that had highlighted them as potential solar siblings, based on motions, ages, and compositions.

Typically, star formation results in the formation of an "open cluster,” a group of young stars that have formed from the same gas cloud. The detailed chemical abundances of

this gas cloud, as measured by traces of elements heavier than helium, are preserved within the young stars.

Open clusters only last for a few hundred millions years, their stars spreading out throughout the galaxy over time. The Sun itself is about 4.57 billion years old, so it's had plenty of time to get lost.

Several astronomers have suggested that the open star cluster M67 could be the Sun's birthplace. But a recent analysis suggests that the Sun and M67 were born in different giant molecular clouds.
ESO / Digitized Sky Survey 2 / Davide De Martin

Fortunately, astronomers don't need a home address to identify solar siblings. By measuring the motions of stars through space, astronomers can "reverse" their motions and see which stars were near the Sun when it formed. You can imagine watching a video of an explosion in reverse: as you play the movie, things that are initially far apart begin to move closer to one another. The same method works here. However, it is important to model the Milky Way's gravitational field correctly, since it influences the motions of these stars. Ramírez and his team measured motions for 30 suspected siblings and were able to "rewind the tape" on each of them.

Next, the team measured the detailed atmospheric composition of each suspected sibling. In order to be a match, the star needs to not only have been close to the Sun about 4.6 billion years ago, but it also needs to have the same age as the Sun and have similar abundances of iron, silicon, oxygen, and other heavier elements.

After this test, only two of the 30 candidates showed a match to the Sun's chemical composition, and only one, HD 162826, was close to the Sun at the time it formed. Thus, this makes HD 162826 the best "solar sibling" candidate to date. This star is about 15% more massive than the Sun, making it one of the Sun's big brothers. At 110 light-years it is also relatively nearby, shining at magnitude 6.7 in the constellation Hercules.

The team found that, instead of painstakingly looking at as many elements as possible, the most useful tactic is to measure the abundances of a handful of elements that vary greatly among stars that otherwise have similar compositions. One of these elements, barium, should be easily observable with medium-resolution spectra, the team says.

Although HD 162826 is slightly more massive than the Sun, Ramírez's team notes that many of the solar siblings are likely to be low-mass *M* dwarfs, since these are the most common type of star made during star formation. Current capabilities likely won't be able to identify these little brothers — *M* dwarfs have crowded spectra that are difficult to analyze, and they're also inherently dim. But with the launch of ESA's Gaia, astronomers will have precise measurements on the motions of millions of nearby *M* dwarfs, which will help isolate which of these were formed alongside our Sun.

Reference: I. Ramírez et al. "Elemental Abundances of Solar Sibling Candidates." *Astrophysical Journal*, in press.

- See more at: http://www.skyandtelescope.com/astronomy-news/sun-sibling-found/#sthash.wChoVkTB.dpuf

Dark Matter Jacket Protects Dwarf Galaxy From Galactic Collision

Fri, 05/23/2014 - National Radio Astronomy Observatory

Like a bullet wrapped in a full metal jacket, a high-velocity hydrogen cloud hurtling toward the Milky Way appears to be encased in a shell of dark matter, according to a new analysis of data from the National Science Foundation's Robert C. Byrd Green Bank Telescope (GBT). Astronomers believe that without this protective shell, the high-velocity cloud (HVC) known as the Smith Cloud would have disintegrated long ago when it first collided with the disk of our Galaxy.

If confirmed by further observations, a halo of dark matter could mean that the Smith Cloud is actually a failed dwarf galaxy, an object that has all the right stuff to form a true galaxy, just not enough to produce stars.

"The Smith Cloud is really one of a kind. It's fast, quite extensive, and close enough to study in detail," said Matthew Nichols with the Sauverny Observatory in Switzerland and principal author on a paper accepted for publication in the *Monthly Notices of the Royal Astronomical Society*. "It's also a bit of a mystery; an object like this simply shouldn't survive a trip through the Milky Way, but all the evidence points to the fact that it did."

Previous studies of the Smith Cloud revealed that it first passed through our Galaxy many millions of years ago. By reexamining and carefully modeling the cloud, astronomers now believe that the Smith Cloud contains and is actually wrapped in a substantial "halo" of dark matter- the gravitationally significant yet invisible stuff that makes up roughly 80 percent of all the matter in the Universe.

"Based on the currently predicted orbit, we show that a dark matter free cloud would be unlikely to survive this disk crossing," observed Jay Lockman, an astronomer at the National Radio Astronomy Observatory in Green Bank, West Virginia, and one of the

coauthors on the paper. “While a cloud with dark matter easily survives the passage and produces an object that looks like the Smith Cloud today.”

The Milky Way is swarmed by hundreds of high-velocity clouds, which are made up primarily of hydrogen gas that is too rarefied to form stars in any detectable amount. The only way to observe these objects, therefore, is with exquisitely sensitive radio telescopes like the GBT, which can detect the faint emission of neutral hydrogen. If it were visible with the naked eye, the Smith Cloud would cover almost as much sky as the constellation Orion.

Most high-velocity clouds share a common origin with the Milky Way, either as the leftover building blocks of galaxy formation or as clumps of material launched by supernovas in the disk of the Galaxy. A rare few, however, are interlopers from farther off in space with their own distinct pedigree. A halo of dark matter would strengthen the case for the Smith Cloud being one of these rare exceptions.

Currently, the Smith Cloud is about 8,000 light-years away from the disk of our Galaxy. It is moving toward the Milky Way at more than 150 miles per second and is predicted to impact again in approximately 30 million years.

“If confirmed to have dark matter this would in effect be a failed galaxy,” said Nichols. “Such a discovery would begin to show the lower limit of how small a galaxy could be.” The researchers believe this could also improve our understanding of the Milky Way's earliest star formation.

Club Officers & Positions:

President:
Brian Risley
swfasbrisley@embarqmail.com
(239-464-0366)

Vice President:
Bruce Dissette
bdissette@centurylink.net
(239-936-2212)

Secretary:
Don Palmer
swfas.sec@gmail.com
(239-334-3471)

Treasurer:
Tony Heiner
verahei@aol.com
(941-457-9700)

Program Coordinator:
Vacant

Librarian:
Maria Berni
(239-940-2935)

Viewing Coords./Fakahatchee:
Tony Heiner
verahei@aol.com
(941-629-8849)
Russ Weiland
turtledude@embarqmail.com
(239-281-0456)

Viewing Coord/Caloosahatchee
Bruce Dissette
bdissette@centurylink.net
(239-936-2212)

WebsiteCoordinator
Bill Francis
Bill_Francis@hotmail.com
(239-233-0958)
Gary McFall
tgmcfall2@yahoo.com
(239-458-9222)

Club Historian:
Danny Secary
asecary@gmail.com
(239-470-4764)

Equipment Coordinator:
Brian Risley
swfasbrisley@embarqmail.com
(239-464-0366)

Newsletter Editors:
Ron Madl
rmadlksu@gmail.com
(785-410-2911)
Doug Heatherly
dheatherly72@gmail.com

Astronomical League Coordinator (ALCOR):
Carol Stewart
cjstewart@mindspring.com
(239-772-1688)

Southwest Florida Astronomical Society, Inc.
P.O. Box 100127
Cape Coral, FL 33910

www.theeyepiece.org