Southwest Florida Astronomical Society
SWFAS

The Eyepiece
August 2014

Contents:

A MESSAGE FROM THE PRESIDENT

This summer has been rough on Star Parties! We did get the Parks and Rec event in, but turnout to the scopes was low due to our positioning and the heat. I would like to thank Tony Heiner, Gary McFall, Nick DiLeo, John MacLean and Johnnie Royal for coming out and helping. (John and Johnnie had it nice in the AC doing handouts!)

Coming up is International Observe the Moon Night on September 6th. We need to decide what we are going to do and where!

This month I will give a presentation on the current Rosetta mission that will be rendezvousing with the comet it will be studying the day before the meeting.

September is tentatively planned for a Messier program by Bruce. We have some other programs planned for the fall as well.

The new Celestron Mount for the PST is working like a champ! Used it at the Parks and Rec event, kept things in for the event with little adjustment needed.

Tony Heiner and I are helping the family of an active astronomer sell his equipment. I will have some equipment and the equipment list at the meeting. Major items are a Meade LX200 Classic 10" f6.3 with tripod, a Celestron Nexstar 6, a Questar 3.5" (1978 BB coatings) with PowerGuide/Tripod, and a Unitron 114. There also is an unopened Scope Buggy and a heavy duty pier/superwedge for Meade. There are some eyepieces and other equipment as well.

Brian

In the Sky this Month

Moon: August – 1st Quarter 3rd ; Full 10th; Last Quarter 17th; New 25th.
The moon will be just two days past full on the peak night for the **Perseid meteor shower**, August 12-13. At nightfall the moon will still be low in the east, so you may still get a good look at some of the longer lasting, earth-grazing Perseids that can occur when the radiant is just above the horizon.

The Planets
Mercury will be difficult to spot, but will be low on the horizon at sunset the last third of the month.
Mars and Saturn remain in the west at magnitudes +0.4 and +0.5, respectively, at month's beginning. Towards month's end, they will be closer together in the vicinity of double star, α Librae (Zubenelgenubi), and both with comparable +0.6 magnitudes. This will make for a nice opportunity to compare the colors of these two planets at comparable brightness.
Neptune reaches opposition on August 29th and is best observed at its highest after midnight.
Uranus is fairly high before dawn. At a 5.8 magnitude, it may be visible to unaided eyes from a dark viewing location. Finder charts are located at **skypub.com/urnep**.
Jupiter joins Venus as a morning star at mid-month. They will be only 4° apart from the 14th through 21st. They will be 0.2 degrees apart on the 18th around 5 hr UT.

Messier Objects – Compare the Open Clusters; M6 (Butterfly Cluster) and M7 in Scorpius with Cr 316 in Scorpius and Cr 399 (Brocchi's Cluster) in Vulpecula.

Double Stars of the Month
Binocular – Epsilon Lyra; Magnitude 4.7, 4.6; Separation 211"

Telescope – Beta Cygnus (Alberio); Magnitudes 3.2, 4.7; Separation 54"

Telescope, Challenging – Sigma Cassiopeia; Magnitudes 5.0 & 7.1; Separation 3".

The International Space Station: Nice viewing opportunities early and late in the month.
Aug 1st at 9:12 pm from SSW to ENE; max alt 31°; for 5 minutes at -2.6 mag.
Aug 2nd at 10:00 pm from WSW to NNE; max alt 27°; for 6 minutes at -1.1 mag.
Aug 3rd at 9:11 pm from SW to NNE; max alt 57°; for 6 minutes at -2.6 mag.
Aug 5th at 9:11 pm from W to N; max alt 17°; for 5 minutes at -0.2 mag.

Aug 23rd at 9:08 pm from NNW to NE; max alt 23°; for 3 minutes at -1.8 mag.
Aug 24th at 9:56 pm from WNW to WNW; max alt 25°; for 2 minutes at -1.0 mag.
Aug 25th at 9:07 pm from NW to SE; max alt 90°; for 4 minutes at -3.4 mag.
Aug 26th at 8:18 pm from NNW to NE; max alt 40°; for 6 minutes at -2.6 mag.
Aug 27th at 9:07 pm from WNW to SW; max alt 21°; for 5 minutes at -1.0 mag.
Aug 28th at 8:17 pm from NW to SSE; max alt 45°; for 6 minutes at -2.3 mag.
Extracted from http://www.heavens-above.com/

Hubble Space Telescope: Not visible in evenings this month.

Future Events

Upcoming Meetings

Our August meeting will be August 7th. Speaker/topic for the evening will be Brian Risley on the Rosetta Comet Mission

Star Party and Event Schedule

Date	Event	Location	Time	Info/Contact
Thursday, August 7th	Monthly Meeting	Calusa Nature Center & Planetarium	7:30 pm	Brian Risley
August 23rd	Star Party	CRP	Dusk	Bruce Dissette
Thursday, Sept 4th	Monthly Meeting	Calusa Nature Center & Planetarium	7:30 pm	Brian Risley
Saturday Sept 6th	International Observe the Moon Night	To Be Determined		Brian Risley
Sept. 27th	Star Party	CRP	Dusk	Bruce Dissette
Thursday, Oct 2nd	Monthly Meeting	Calusa Nature Center & Planetarium	7:30 pm	Brian Risley
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 – June 5, 2014

The June 5th 2014 SWFAS meeting was called to order in the planetarium at 7:30 by Brian Risley. Brian asked if there were any visitors or new prospective members present.

Brian Risley and Carol Stewart thanked members for assisting at the Skyline Elem. event on Friday, May 9th. Johnnie Royal, Tony Heiner, Brian Risley, Carol Stewart, Gary McFall, and Doug Heatherly helped to make the evening very successful. There was a great turnout, the skies were clear and everyone had a good time.

Carol Stewart also thanked Gary Mcfall, Bruce Dissette, Tony Heiner, and Doug Heatherly for assisting with Astronomy Day at the planetarium which also was a great success on Saturday, May 10th.

Carol Stewart also thanked Scott Flaig for coming out for the May evening astronomy program to present a program on his book as he had done previously for a SWFAS meeting. There were about five total visitors for the program.

Brian Risley asked if the members would like to go to the RC Seahawk Park in Cape Coral for the star party on June 28th instead of CRP. Carol Stewart moved to accept and Tony Heiner seconded the motion. Motion passed.

Brian Risley reminded members about the Cape Coral Parks & Recreation Day on Saturday, July 19th at the Cape Coral Yacht Club, and to let Brian know if anyone can help out with solar observing.

It was decided to leave it open, for now, where the members would go for the July 26th star party.

Brian Risley talked about the Coconut Point Hyatt telescope program. They purchased a CPC1100 and Brian will help them learn how to set up the scope and make a manual for them to follow as well. Carol Stewart will provide handouts to advertise CNCP and the planetarium and quarterly observing targets for the staff to use with their guests.

Brian Risley thanked Jordan Blessing, SWFAS member, for the bolt cases donation that we received at the Skyline Elem. event. There were 2 cases of these items…all for free from Jordan. Thank you Jordan! SWFAS will be selling these for $1.50 each and proceeds will help fund a PST mount project for the club. Gary McFall made the motion to proceed in the sale of these items and Brian Shultis seconded the motion. Motion passed.

Brian Shultis made a motion to cancel the July 3rd, 2014 SWFAS meeting.
Motion was seconded and passed.

Carol Stewart told members about the upcoming June evening program on Hurricane Preparedness presented by the Lee County Emergency Operations Center staff on Wednesday, June 25th. She also told members that Scott Flaig is a new board of trustee for the CNCP and will be specifically working on the planetarium committee to help move the facility forward.

Reports:

The VP, Bruce Dissette, was not present. There was nothing new to report on the newsletter. Don Palmer was not present, and Tony gave the treasurer report.

Brian Shultis moved to accept the treasurer's report and Stephen Berni seconded the motion. Motion carried.

Chuck Pavlick talked about the Fakahatchee observing nights. Brian and others mentioned that hardly any meteors were seen from the possible new Camelopardalids meteor shower.

Maria Berni had nothing to report on the library. Danny Secary, historian, was not present. Brian Risley gave a brief equipment report and told members SWFAS has lots of telescopes to loan out.

Bill Francis was not present to report on the web site and Brian Risley told members we still need a program coordinator.

Brian Risley told members that the Astronomical League membership fees are due at the end of June and that he is in the process of contacting members who have not renewed their dues for this year to get our membership list in order. The dues invoice will be paid by Tony Heiner once Brian has everything in order.

Brian Shultis moved to accept payment of the AL dues and Tony Heiner seconded the motion. Motion carried.

Mary Vilbig suggested that Brian should talk a little about the AL and what all it has to offer members for those that may not know. Brian discussed that receiving the Reflector magazine was one benefit and how the AL observing programs can help members through structured observing projects.

Brian Risley talked briefly about the Night Sky Network web site being revamped recently.

Meeting adjourned.

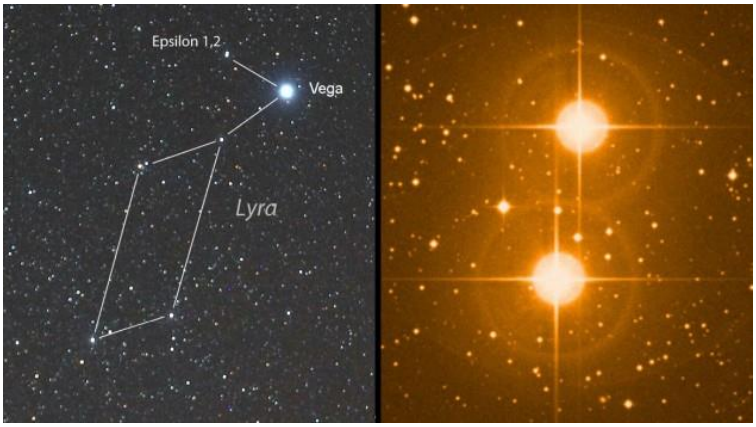
Brian Risley presented a thorough program about solar observing that included different methods to observe the sun, features easily seen with white light and HA scopes, and specific names and types of features seen on the sun.

Meeting notes submitted by Carol Stewart

See Summer’s Best Naked-Eye Double Stars

By: Bob King

Here's a guide to some double stars — both real and coincidentally aligned — that you can split using just your eyes on warm summer nights.



Epsilon^{1,2} Lyrae, a challenging naked-eye double star, lies near the brilliant star Vega in the constellation Lyra. At right, the pair is seen magnified.
Bob King (left) / ESO Digitized Survey (right)

Years ago, my younger daughter Maria and I camped in northern Minnesota. One chilly evening in August during the Perseid meteor shower, we built a big fire and stretched out on our backs next to it to stay warm.

Vega beamed down from overhead, and next to it, the famous double-double star, Epsilon Lyrae. I asked my daughter and her young eyes to see if she could split the wider pair, Epsilon^{1} and Epsilon^{2}. She looked for a minute and then said: "Sure, Dad, one is right above the other" — then she added, "Can't you?"

I figured it was out of my league, but with Maria's encouragement I could split it too. A revelation! As I recall, my eyes were age 49 at the time. That got me to thinking about what other doubles — real and line of sight pairings — might be within reach of our biological optics.

In researching naked-eye pairs for summertime viewing, I discovered there are surprisingly few *true* naked-eye doubles. Most are line of sight or optical pairs — stars that happen to lie in the same direction but either at very different distances or at similar distances but moving in entirely different directions.

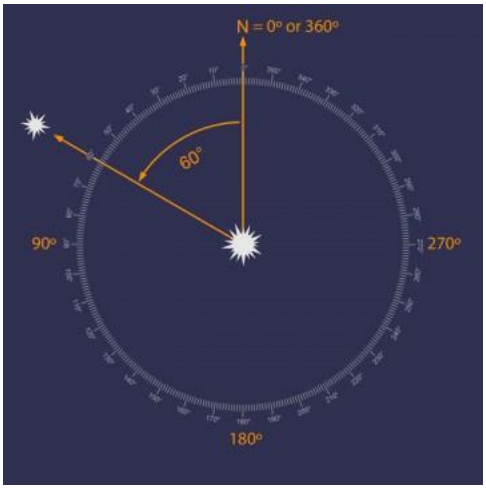
Three of the best trickster doubles and one real one: Alpha Capricorni (nearby Beta Cap is a true double), Omega Scorpii, and Omicron[1]-30 Cygni.
Source: Stellarium

Here are a few of my favorite fakes, which are shown schematically above:

• **Alpha[1,2] Capricorni** — Two tiny 4th-magnitude beads that remind me of a mother holding her child close. A relatively easy pair.

• **Omega[1,2] Scorpii** — Easiest of the bunch to split. Pity it's only an optical pair.

• **Omicron[1], 30 Cygni** — So close they almost touch! A rewarding challenge.



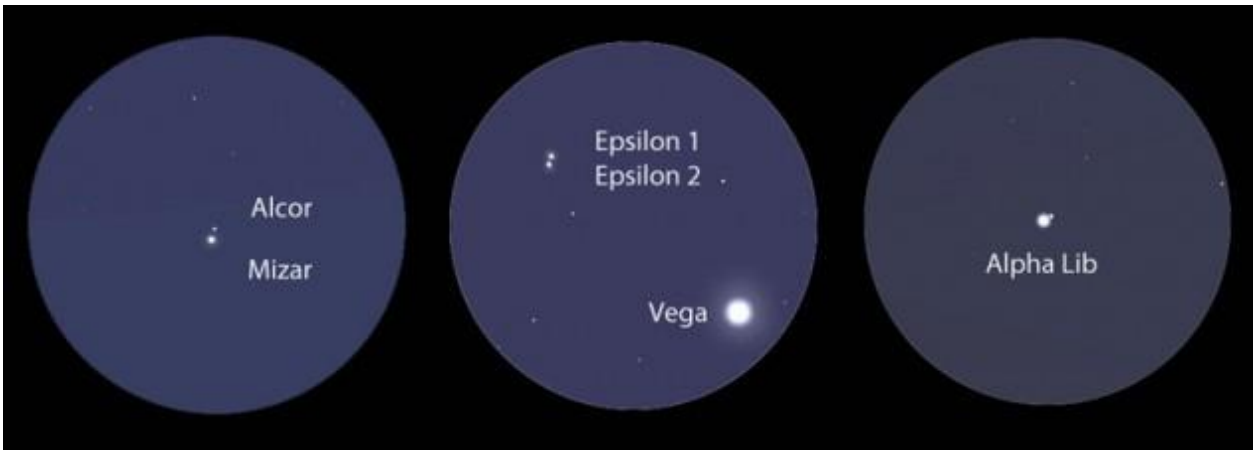
Use this position angle (PA) guide to help you know what direction to look for a double star's companion.
Source: Wikipedia

In the table at the end of this article, you'll find more details about these and other pairs including the components' respective magnitudes (brightnesses), their separation in minutes of arc (60 arcminutes = 60′ = 1°), and "PA" (position angle), the direction the fainter of the two stars lies relative to the brighter.

A PA of 0° indicates it's due north, 90° is east, 180° south and 270° west. The graphic at right shows this. But be aware that celestial north isn't merely "up" — it's the direction toward Polaris, the north Star. Finding north when looking through your telescope can be tricky too, depending on whether the field of view is merely rotated or mirror-reversed.

Real Double Stars

Now let's take a look at the real deal. My selection criteria were simple: each member of the stellar pair had to be equal to or brighter than the 6th-magnitude naked-eye limit and separated by a minimum of 2 arc-minutes. While the human eye *can* resolve details only 1’ across, most of us can do 2’ at best. I'm guessing you'll find that taxing enough.



Three of summer's four naked-eye double stars — Mizar-Alcor, Epsilon^{1,2} Lyrae, and Alpha Librae. *Source: Stellarium*

Drum roll, please! There are exactly *four* summer sky pairs visible from mid-northern latitudes:

• **Mizar and Alcor** — Famous double in the bend of the Big Dipper's handle. Brightest and easiest of the true doubles. The ability to separate this pair has often been regarded as a test of good vision. Easiest on the list — it gets tougher from here.

• **Alpha Librae** — Named Zubenelgenubi, the brightest star in Libra is presently not far from Saturn. From my observing site in northern Minnesota, Libra is relatively low in the sky, making this one tricky. I suspected the dim companion with averted vision.

• **Epsilon^{1,2} Lyrae** — The wider of the two pairs of the famous "Double Double." A great challenge and, I think you'll agree, absolutely exquisite. Each is double again when viewed at medium to high magnification in 3-inch and larger telescopes.

• **Beta Capricorni** — Very challenging because of the components' unequal brightness *and* faintness of the companion star. Good luck!

Since I've whetted your appetite for eyeball doubles, it would be unfair to walk away and leave you so few to enjoy. Just as many of us still find the taste of banana appealing even when used as an artificial flavoring, I've included a few more "artificial" doubles below to fatten up your list.

Whether you cleave any of these doubles with your naked eye or not, low-power binoculars such as 7×35s or 10×50s will do a magnificent job splitting every single one. When you've conquered these, you might find yourself craving more. I promise to return with a fall-winter list later this year.

For more information on binocular/naked eye doubles, check out the Astronomical League's **Binocular Double Star list** and a spate of ***Sky & Telescope* articles** on the topic.

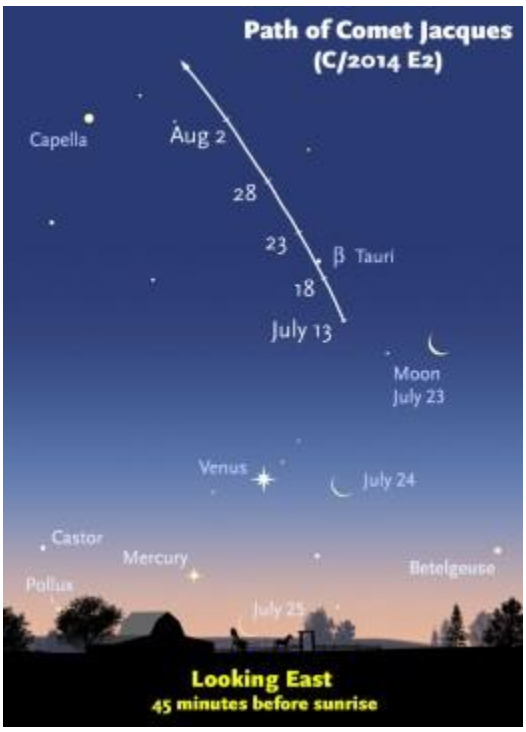
Star names/designations	***Type***	***Mags.***	***Sep., PA***	***R. A.***	***Dec.***
Mizar-Alcor	True	2.2, 4.0	11.8′, 70º	$13^h\ 24^m$	+54º 55′
Alpha Librae	True	2.7, 5.2	3.8′, 315º	$14^h\ 50^m$	–15º 59'
Epsilon[1,2] Lyrae	True	4.6, 4.7	3.5′, 182º	$18^h\ 44^m$	+39º 40′
Beta Capricorni	True	3.2, 6.1	3.4′, 267º	$20^h\ 21^m$	–14º 47′
Alpha[1,2] Capricorni	Optical	3.7, 4.3	6.3′, 292º	$20^h\ 18^m$	–12º 32′
Kappa Draconis	Optical	3.9, 4.9	15.4′, 25º	$12^h\ 33^m$	+69º 47′
Omega[1,2] Scorpii	Optical	4.0, 4.3	14.6′, 145º	$16^h\ 6^m$	–20º 41′
Nu Coronae Borealis	Optical	5.4, 5.6	6′, 164º	$16^h\ 22^m$	+33º 48′
Mu[1,2] Scorpii	Optical	3.1, 3.6	5.8′, 72º	$16^h\ 52^m$	–38º 03′
Zeta Scorpii	Optical	3.6, 4.7	6.5′, 270º	$16^h\ 54^m$	–42º 21′
Delta[1,2] Lyrae	Optical	4.3, 5.6	10.3′, 295º	$18^h\ 54^m$	+36º 54′
Alpha Vulpeculae	Optical	4.6, 5.9	7.1′, 28º	$19^h\ 28^m$	+24º 40′
Omicron[1], 30 Cygni	Optical	3.9,4.8	5.6′, 325º	$20^h\ 13^m$	+46º 44′
Pi[1,2] Pegasi	Optical	4.3, 5.6	9.5′, 268º	$22^h\ 10^m$	+33º 11′

Want to chase down more of these pretty pairings? Double Stars For Small Telescopes is an annotated catalog compiled by one of today's most experienced double-star observers — comprehensive and user-friendly!

See Comet Jacques Before Dawn

By: Kelly Beatty

After a slow four-month climb from obscurity, Comet C/2014 E2 has emerged from behind the Sun and can be viewed low in the eastern sky before the first light of dawn begins.



Comet Jacques (C/2014 E2) is moving into better view in the hours before dawn. Look at least 90 minutes before your local sunrise time while the sky is still dark! Planets are positioned for July 24th. At the telescope, you'll probably need to use this more detailed map (Courtesy Bob King) to pinpoint the comet's location among stars to 6th magnitude.

It's been a long time since we Earthlings have been treated to a spectacular comet (at least here in the Northern Hemisphere). So these days we'll take whatever little gauzy apparitions we can get.

For the next couple of weeks, you can train your telescope low in the eastern sky before the first light of dawn to look for Comet Jacques (C/2014 E2). Observers report that this interloper has gradually brightened from obscurity and is holding steady at about 6th magnitude. The comet should be about as bright right now as it's going to get.

As the chart here shows, this week Comet Jacques is climbing higher in the hours before dawn, skirting the western stars of Auriga before moving on into Perseus. Its *elongation* (angular separation) from the Sun is about 40°, and that will grow to 50° over the next week.

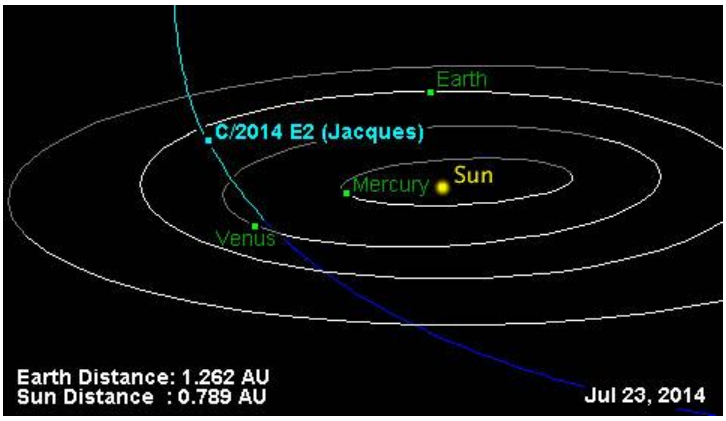
Here's how Comet Jacques (C/2014 E2) looked three months ago, on April 26th. Spanish observer José J. Chambó used an 8-inch telescope and stacked together eight 120-second-long exposures.

With New Moon approaching, bright moonlight will not be a hindrance. Visually, the comet is not sporting an obvious tail, though a long, waving streamer was captured by one of NASA's STEREO spacecraft. But the cloud-like coma surrounding its nucleus is fairly condensed and concentrated, which improves your odds of success. Pick a clear, haze-free morning to go hunting.

If you do spot Comet Jacques, please post a comment below and include your circumstances (location, time, equipment used) to help others in their quest.

Comet Jacques's Close Brush with Venus

It's a pity we couldn't have viewed this visitor from the vantage point of Venus. Back on the 13th, that planet and the comet were just 9 million miles apart! The only spacecraft in that immediate vicinity is the European Space Agency's Venus Express. But right now this orbiter is wrapping up some challenging aerobraking maneuvers that have kept the mission team preoccupied.



Comet Jacques is heading out of the inner solar system, but it came very close to Venus on July 13, 2014. *JPL Horizons*

(I asked project scientist Håkan Svedhem about taking a few snapshots, and he replied, "By mid-July we should be finished, and if everything is still OK we might be able to do something with this comet.")

The comet has brightened thousands of times since Cristóvão Jacques, João Ribeiro de Barros, and Eduardo Pimentel captured it on March 13th in CCD images taken with the 0.45-m reflector at SONEAR Observatory near Oliveira, Brazil.

SONEAR stands for "Southern Observatory for Near Earth Asteroids Research," but of course discovering a comet is even better! In fact, this trio of observers had discovered another comet, C/2014 A4, just two months earlier.

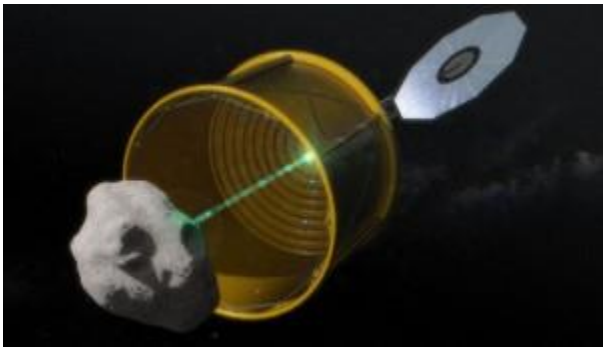
- See more at: http://www.skyandtelescope.com/astronomy-news/observing-news/see-comet-jacques-dawn-07232014/?et_mid=683988&rid=246752253#sthash.6HQ3u1Qb.dpuf

NASA Amassing Targets for Asteroid Mission

By: Monica Young

Despite skepticism from scientists and politicians alike, NASA is proceeding with its asteroid redirect mission and has found six candidates for exploration so far.

Usually, the saying goes, getting there is half the battle. In the case of NASA's Asteroid Redirect Mission (ARM), finding "there" might be the bigger challenge.



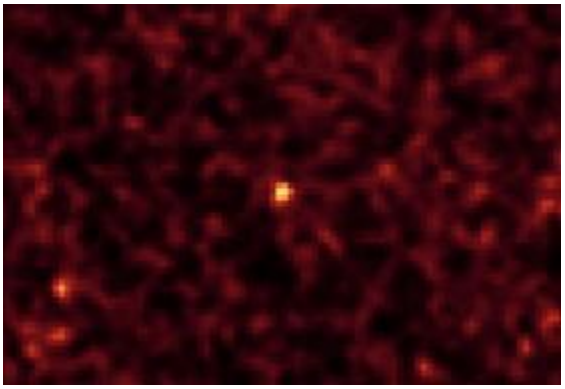
This concept shows ARM robotic capture Option A in which the robotic vehicle deploys an inflatable bag to envelop a free-flying small asteroid before redirecting it to a lunar distant retrograde orbit.
NASA

When NASA first announced the mission to find, retrieve, and explore an asteroid, the community reacted with skepticism. Finding asteroids, especially small ones, is hard —

and finding small asteroids with just the right criteria for a robotic rendezvous is even harder. An alternative option, flying to a bigger asteroid and retrieving a boulder off its surface, was even added as a possibility to help enlarge the pool of candidates.

Now NASA has announced that they have collected six "valid candidates" between the two options, where "valid" indicates that follow-up observations show the objects meet rendezvous criteria.

For Option A, which aims to bag a whole, small asteroid and bring it back to lunar retrograde orbit, the three criteria are size, spin rate, and mass. Mission planners have three valid candidates so far: 2009 BD, 2013 EC20, and a new candidate announced yesterday, 2011 MD. Each candidate is less than about 10 meters across and spins less than once every 2 minutes. The mass limit depends on the asteroid's orbit.

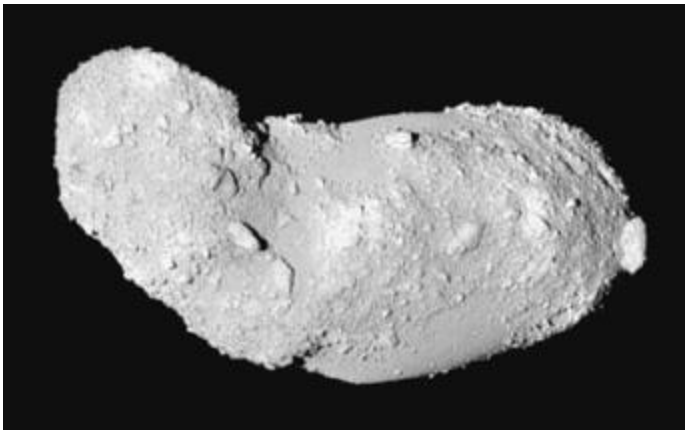


Spitzer stared at 2011 MD for 20 hours to capture this infrared image, enabling astronomers to measure the asteroid's temperature, and hence its size and density. *NASA / JPL-Caltech / Northern Arizona University / SAO*

2011 MD, the biggest candidate so far, is between 4 and 10 meters across (13 to 32 feet) and has a surprisingly low density, roughly that of water. Based on the size and density, its mass is somewhere between 50 and 350 tons. This asteroid passed very close to Earth in 2011, enabling its discovery and tweaking its orbit such that it's a good target for a rendezvous in 2024.

Earlier this year, NASA's Spitzer Space Telescope, whose orbit trails Earth's, stared at 2011 MD for 20 hours to characterize the object's temperature, and therefore its size. The low density probably means that the asteroid is really a fleet of flying boulders, though it's also possible that the asteroid is a single rock surrounded by a haze of smaller rock particles.

Regardless of the asteroid's true nature, Option A would have the robotic spacecraft grab the whole thing in a bag and haul it back to an orbit 70,000 km above the lunar surface.



The Hayabusa spacecraft acquired this view of 25143 Itokawa on October 4, 2005, hours after moving to within 7 km of the asteroid. The rough-textured terrain shows evidence for retrievable boulders.
JAXA

The alternative, Option B, involves retrieving a boulder from a larger asteroid and has fewer constraints, requiring only an accessible orbit and confirmation of boulders on the asteroid's surface. But observational evidence for boulders is hard to obtain. So far, three candidates have made the list for Option B: Itokawa (pictured at right), 2008 EV5, and 101955 Bennu, the target of the upcoming OSIRIS-Rex mission.

In addition to widening the playing field of potential targets, Option B has a side benefit: testing planetary defense. Option A by definition has NASA targeting asteroids that are too small to matter when it comes to close encounters — if these asteroids ever ventured too near Earth, they would mostly burn up in the atmosphere. But Option B targets asteroids 100 times larger, and the robotic spacecraft could demonstrate techniques such as the gravity tractor or ion-beam deflection either before or after picking up the boulder.

Paul Chodas (NASA JPL) estimated that NASA's searches might find an additional two to three candidate asteroids per year until 2018, at which time the agency will have to decide both which option they're going with and which asteroid they'll target for a projected 2019 launch.

As the search for asteroid candidates continues, work begins on retrieval mechanisms. NASA also announced yesterday 18 proposals that will share $4.9 million over the next six months to investigate technology for rendezvous sensors, asteroid capture, adapting commercial spacecraft, and more. See NASA's press release for the full list of accepted proposals.

Facing the Skeptics

Despite meeting rendezvous criteria, the asteroid 2011 MD is still a bit of a mystery. It might be a rubble pile (left) or a single rock clouded by rock particle haze (right). *NASA / JPL-Caltech*

NASA's announcement was intended no doubt to soothe critics in the political and scientific communities alike. Just last week, the U.S. National Academy of Sciences issued a report that urged a return to the Moon rather than a singular focus on asteroid retrieval. Meanwhile, lawmakers have voiced their unease about the asteroid retrieval mission's lack of a firm schedule and budget.

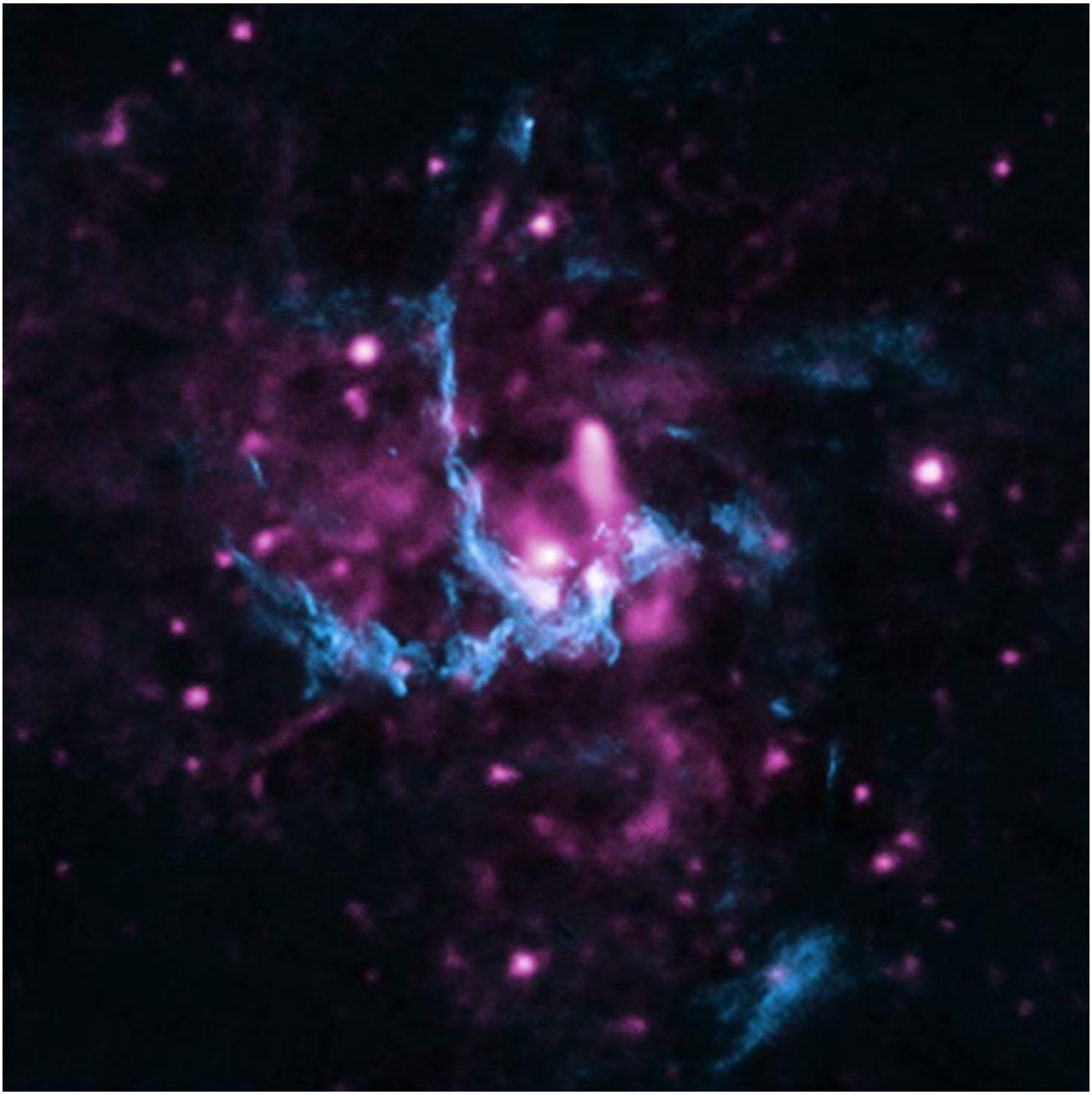
"Our briefing reminded the community that we have some viable candidates already for this proposed mission," Chodas says, "and the prospects are good for finding more viable candidates."

But Jim Bell (Arizona State University), president of The Planetary Society, counters, "Finding suitable targets is just one step in NASA proving that the Asteroid Retrieval Mission is a feasible project." As described in a recent statement from The Planetary Society, the agency also needs to produce an independent assessment of the mission's likely costs and of the technical implementation that NASA plans to pursue, he explains. "Hopefully those additional steps will be coming soon."

- See more at: http://www.skyandtelescope.com/astronomy-news/nasa-amassing-targets-asteroid-mission/#sthash.4QRHvMX0.dpuf

Triple Monster Black Hole Discovered

Sometimes big, bad things comes in threes, including jumbo black holes.



The new study suggests that many galaxies have not one black hole (as in the illustration above), but two or more giant black holes in their centers.

PHOTOGRAPH BY NASA/CXC/UCLA/Z.Li AND NRAO/VLA

Michael Lemonick for National Geographic

The discovery of a trio of jumbo black holes circling the center of a distant galaxy, reported by astronomers on Wednesday, suggests that pairs or triplets of such monsters may be surprisingly common.

Astronomers have learned over the past decade or two that virtually every full-size galaxy such as our own Milky Way has a giant black hole lurking in its core. These monsters weigh in with a mass equal to millions or even billions of stars. (Related: "Black Hole: Star Eater.")

The new observations, however, described in the journal *Nature*, suggest that many galaxies have not one, but two or more giant black holes in their centers, orbiting each other in a tight gravitational dance that will ultimately lead the objects to merge together into something even more gigantic.

Watching these mergers will offer insight into how gravity behaves when stretched to its limits, astronomers predict, with clues revealed by monster black hole mash-ups such as the just-discovered triplet. (See: "Photo Gallery: Black Holes.")

"We were quite surprised to find it," says Roger Deane, of the University of Cape Town in South Africa, lead author of the report.

Supermassive Neighbors

In one sense, Deane and his colleagues shouldn't have been surprised. It's widely accepted that when galaxies come close together, their gravity can force them to form a single agglomeration of stars. In fact, the Milky Way and the (relatively) nearby Andromeda galaxy will probably experience such a merger in about four billion years. Since each galaxy hosts a single massive black hole, the resulting single galaxy should end up with two.

In practice, however, astronomers haven't found many double black holes. One popular explanation has been that the black holes fuse together very quickly, leaving few doubles for astronomers to find. Another explanation, says Princeton astrophysicist Jenny Greene, who wasn't involved with this research, is that they orbit each other so closely that they're hard to pick out.

"In principle," she says, "there could be a huge population of binary black holes separated by just a few light-years."

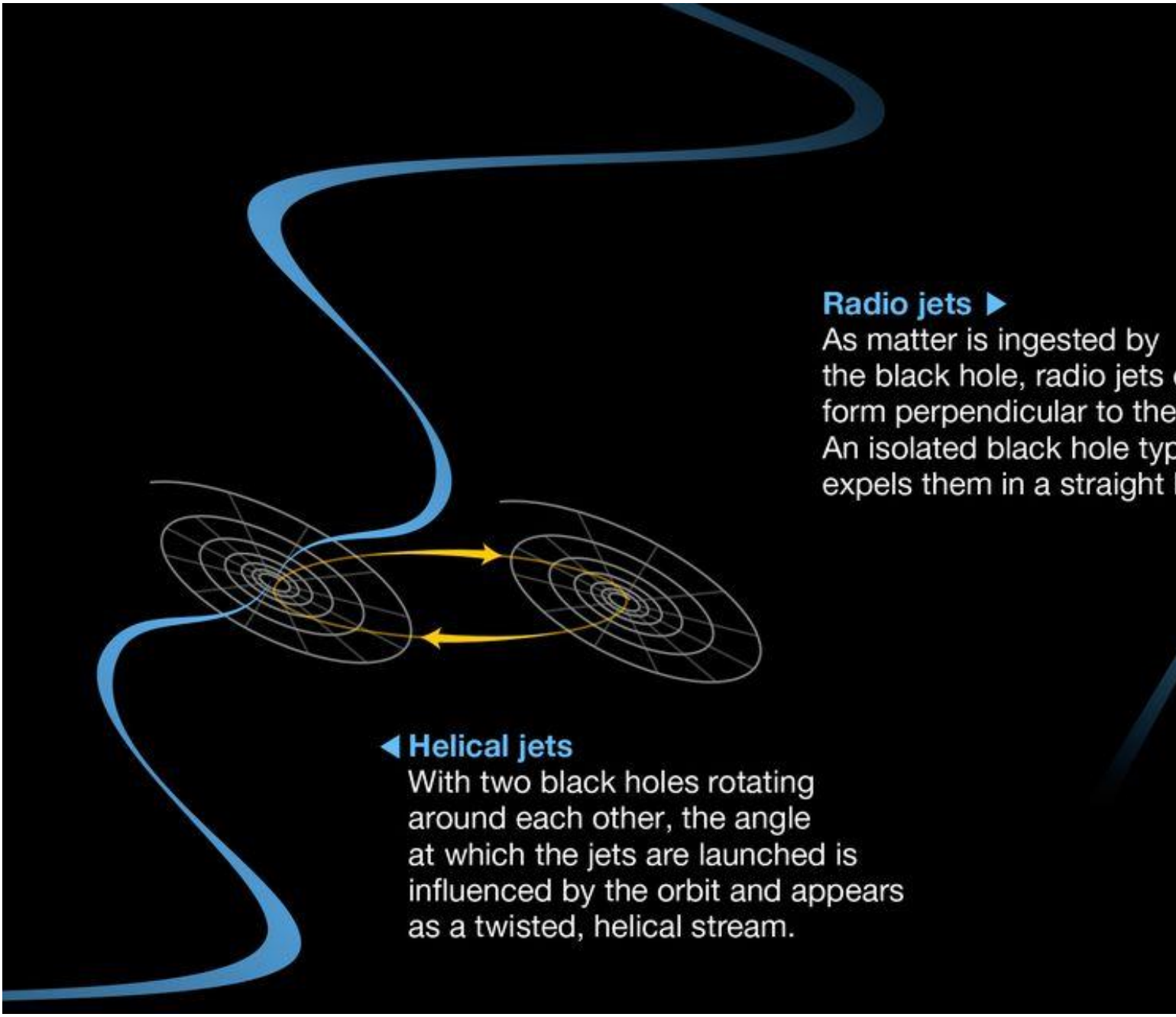
Invisible Whirlpools

Deane and his group originally became interested in this particular galaxy, known by the unwieldy name SDSS J150243.091111557.3, because it had been flagged by the Sloan Digital Sky Survey (thus the "SDSS" in the name) as having what looked like two sources of bright light in its core.

That indicated the possibility of two black holes there, with the light coming not from the invisible objects themselves but from the whirlpools of gas heated to incandescence as they spiral in under the black holes' intense gravity. Jets emitted by the black holes pinpointed their location.

Seeing black holes

Astronomers detect signals from supermassive black holes by observing jets emitted by these galactic monsters.



Jason Treat, NG Staff. Source: Roger Deane, University of Cape Town.

To try to understand what they were looking at, the astronomers observed the galaxy with the Very Long Baseline Array, or VLBA, which combines images from a score of radio telescopes located in South Africa, Europe, the U.S., Russia, and China. The telescopes' wide geographical separation allowed the scientists to view the galaxy and its patch of sky with extremely high resolution.

Sure enough, they found two black holes, separated by several thousand light-years.

But they also discovered that one of them was actually two jumbo black holes, orbiting so tightly that they had appeared to be a single object. The tight pair, Greene says, "is so sexy is because we really don't know whether black holes ultimately merge."

Chains of Gravity

Theory suggests that they might not, or at least not for many billions of years. The two tightly bound black holes are only 460 light-years apart, orbiting each other once every 150,000 years.

In order to spiral into each other, black holes have to jettison some of their orbital energy. One way to do that is by flinging away nearby stars or gas.

After a certain point, however, there aren't any more stars in their neighborhood to fling: The only way they can get rid of energy is by radiating it away in the form of gravitational waves, a phenomenon predicted by Einstein but never directly observed.

Those waves would become more violent as the black holes came very close to each other, making them detectable in principle by a space-based gravitational-wave detector known as the Laser Interferometer Space Antenna, or LISA, which has been proposed but not yet funded.

"If we can get an idea of what fraction of galaxies have [tightly orbiting black holes]," says Greene, "we can start to constrain how likely it is that LISA will detect gravitational waves."

The good news is that Deane and his colleagues found their one tight pair after looking at just six galaxies. While the pair isn't orbiting closely enough to be picked up by LISA, its discovery suggests that there could be plenty of much tighter pairs out there as well, he says. "Either these are a lot more common than previously thought—or we just happened to be incredibly lucky."

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