NIGHTFALL

A PUBLICATION OF THE HUACHUCA ASTRONOMY CLUB

SEPTEMBER 2020

PRESIDENT'S NOTES

Planets, Yep We've Got Them!

Well, it's September 2020 so we're nearly through the monsoons and that is good news for those following Mars. We are closing in on the red planet, and so far, that planet's dust storms that ravage our views have not occurred (knock on Unobtainium). However, as of this writing (late August), we are experiencing massive fires on our own planet along the Pacific coast. There are numerous fires in southern California that are sending smoke our way. But there are many more fires throughout the state. One of those fires, the SCU Lightning Complex (San Jose Area) fire is, at this writing, still threatening the University of California's Lick Observatory atop Mt. Hamilton. The soot from these fires has darkened and tinted our local skies for over a week.

Still, even with the smoke in our air, Mars is showing some smaller surface features. The small southern ice cap is prominent in this August 19 image. Also, a light spot just on the sunny side of the terminator hints at Elysium Mons, one of several big volcanoes sometime visible to mid-sized amateur telescopes. Even a small telescope can detect the changes of the polar caps. But more on this later.

MARS BEFORE (LEFT) AND AFTER (RIGHT) SMOKE ARRIVED FROM CALIFORNIA

Source: David R., Left image 19 Aug, Right image 20 Aug 2020. Same settings and adjustments

Whenever you are out in the evening, look for Jupiter and Saturn and examine them for practice. These two gas giants are well placed high in our sky ready for your scrutiny. Both are within the boundaries of the constellation Sagittarius, deep in the richness of the Milky Way, but their brightness should make them standouts. The brighter of the two is Jupiter, and then Saturn is to the west. In the past I have described technical features to look for and examine as a way to train your eyes for planetary features, but I have failed to mention that, as planets go, they are just plain pretty. Even in small telescopes, they hold the viewer spellbound, especially the first time you see them. For most of us (astronomers, amateur, or otherwise) it was that first look at Saturn or Jupiter that won us over to the hobby or profession.

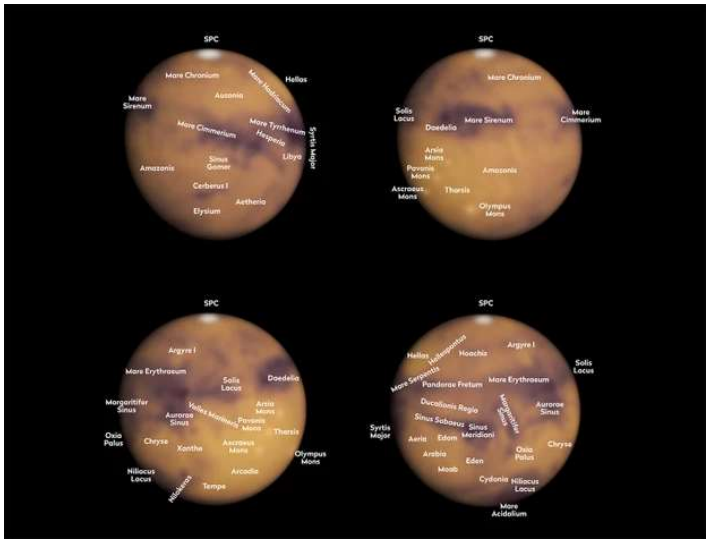
The last couple of years working the outreach evenings at the Patterson Observatory I've felt a little sorry for the visitors. Sure, we were able to show them the Moon, globular clusters, planetary nebulae, galaxies, and even a comet or two, but not Jupiter or Saturn. The Moon is always a big hit and a good hook, but those two gas giants are the kickers. So, whenever we ourselves get a chance to look at these wonders, we should take in long doses of their reflected photons. Saturn with its ring and half dozen little moons, and Jupiter with its atmospheric banding and four Galilean moons. They truly are two of only a handful of objects out there that look just as good in one of our telescopes as the pictures we see. Ah, to remember the thrill we all experienced in our youth when we first looked at those two bright wandering dots in the sky.

And of course, if you're out in the cool of early morning, then Mars is a must. We've still got a couple of months before Mars is at its biggest and brightest, but who knows how many clear nights we'll have before October 13, 2020, when Mars reaches opposition. So, don't hesitate to take a look.

And let's say you're not up to date on your Mars geography or nomenclature. There is abundant information at your

disposal. Both major US astronomy magazines, *Astronomy* and *Sky & Telescope* will no doubt have special articles on Mars. There is also much information on the web, including a staggering number of maps and atlases. There is even Google Mars (like Google Maps) that you can resize and angle as you see fit. Until that time, try to acquaint yourself with the planet, and just enjoy the ride as we overtake the red planet (orbitally and metaphorically speaking).

A good example of the Mars References Available to You on The Web



Source: https://www.skyatnightmagazine.com/advice/skills/how-to-observe-mars/

A small scope can show the larger markings, while any telescope with a diameter of six inches or over will begin to reveal more surface detail. In these south-up views Mars rotates right to left with the orientation shown. Credit: Pete Lawrence

Anyway, I want to keep kick-starting you to get out there and look (even before Earth really closes in) to track the changes over time, in planet size and the surface features. Oh, and then I'll try to get you to spend your evenings watching the subtle feature changes and sense the slight phasing as Mars recedes once again from our perspective.

So, as always, get out there and stare.

Welcome our new member

Jeffrey Enzler of Sacramento California, a long-time friend of HAC president David Roemer, joined the club in August. Welcome, we are glad you joined.

Elections for HAC officers

Officer elections take place in November. There are eight elected seats on the board of directors, the four officers (President, Vice President, Secretary and Treasurer) and four at-large board members. A ninth seat is filled by the most recent past president. Currently, that position is filled by our previous Vice President as there are no past presidents available.

At this writing, it is unknown, how many of the current officers and board members are willing to continue in their present roles or are candidates for other positions. Most of the current leadership has served for a number of years. "Willingness to step down in favor of a new candidate" is perhaps universal at this point.

If you are willing to serve on the board, please speak up. If you know of another member that has expressed interest in serving, please encourage them – and let a current member of the board know who they are.

Current members of the board will be reaching out to other members that they think may be willing to serve. A special COVID-era election procedure will be promulgated to facilitate this year's election given that an "in-person" November meeting is unlikely.

Renew your Astronomy Magazine online

Discounts on your Astronomy Magazine subscription is one of the benefits of club membership. To make things easier on us, Astronomy Magazine now allows club members to receive their discount directly. If you would like to subscribe or renew your subscription to Astronomy, just use this link: **www.astronomy.com/clubmember** there are no codes required. Please retain or bookmark this link if you are an Astronomy magazine subscriber for use at renewal time.

PLEASE NOTE THIS CHANGE Regarding Calendars for 2021:

In past years, Astronomy has offered their Deep Space Mysteries Calendar to club members at half price only when purchased through the club, by the treasurer. But now, members can just go online and get their discount by visiting **MyScienceShop.com/ASYClubs** and using the code **CAL50** at checkout.

Therefore, we will not be making a group order for calendars this year. If you would like a discounted calendar, just go online and purchase it.

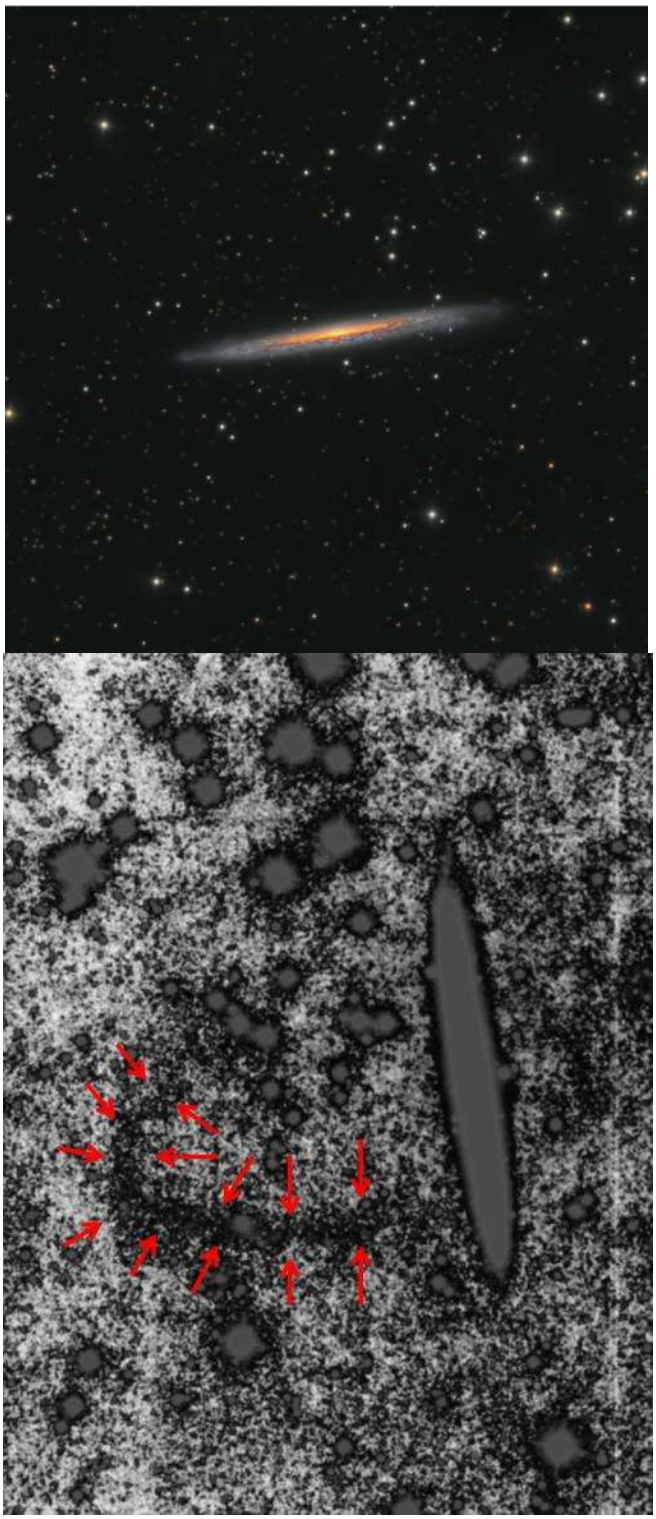
One Small Patch of Sky

Alex Woronow, 2020

NGC 5907 - a Galaxy of Controversy

The galaxy NGC 5907 (aka "the Splinter Galaxy") presents nearly edge-on, with a prominent dust lane delineating its galactic plane. The galaxy's disk exhibits a slightly downward warping (at the right end in Fig 1, top), a feature presumably caused by gravitational interactions with another galaxy. Currently, however, no other galaxy lies close to NGC 5907. One might ask whether other evidence

of gravitational interactions exist. Yes, other evidence exists. But controversy has arisen concerning the exact nature of some of the evidence. The processing and researching of my image in Fig 1 led me to discover the fascinating head-to-head disagreement between professionals and amateurs over that evidence.



OTA: RCOS (14.5" f/8)
Camera: SBIG STX-16803
Observatory: Deep Sky West
Exposures: Red: 08 x 1200 sec, Blue 11 x 1200 sec, Green: 12 x 1200 sec, Lum.: 07 x 1200, Total exposure ~12.7 hours, Image Width: ~0.5 deg.
Processed by Alex Woronow (2020) using PixInsight, Skylum, Topaz
Fig 1: (Top) An image of NGC 5907 captured by a RCOS 14.5" telescope and processed by the author. (Bottom) The negative of the Super-Luminosity extracted from the top image and processed to reveal the western loop (between the red arrows) that forms the center of controversy recounted in this article. Detail of the image-capture parameters appear at the lower right. Image processing did not employ any masking or painting. (Image is rotated 90° clockwise from Fig 1.)

WHERE THE CONTROVERSY STARTED: In 1998, Shang, et al., using the Very Large Array (VLA) radio telescope first observed a "faint ring structure" proximal to NGC 5907. The structure was a wisp of dust and stars, apparently, extending from the eastern side of the galaxy (Fig 2). Imaging that structure lies within the capability of many amateur rigs as well (Fig 1). The structure was interpreted as indicating a prior gravitational interaction with a since-devoured dwarf galaxy.

"**AN AMAZING IMAGE**": Ten years later, amateur astronomers (Martinez-Delgado, et al, (2008) henceforth "MD"), published an article in a professional journal that revealed not a single dust/star trail, as imaged by Shang, but a complex pair of loops tangling around the galaxy. Gabany's image from that article, or a derivative of it, became a NASA APOD in 2008: https://apod.nasa.gov/apod/ap080619.html (Fig 3). The remarkable, "iconic," image implied a dramatic tale of galactic accretion and became distributed and widely accepted as an improved image over the coarse image by Shang, et al. from 1998. MD claimed to reach a surface brightness of 28.5 mag/arcsec^2 using their 0.5m telescope. That accuracy of MD's image has been challenged!

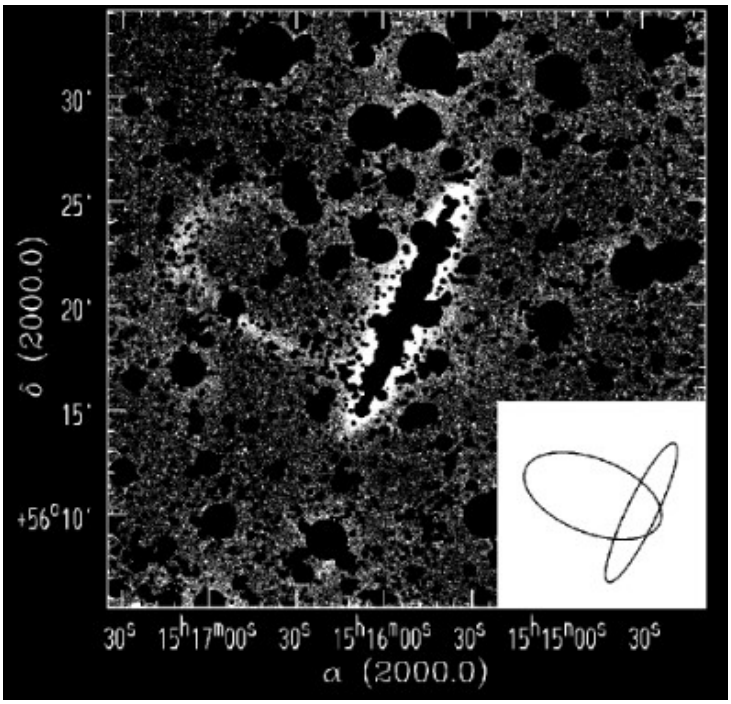


Fig 2. VLA image of NGC 5907's eastern dust and star stream by Shang, et al. (1998)

Fig 3. Astronomy Picture of the Day (APOD) of NGC 5907 from R. Jay Gabany and others from the MD team (2008). This image was obtained using a newly commissioned 0.5m telescope located in Mayhill, NM.

THE BIG-GUN CHALLENGES: MD's image suggested to professional astronomers an opportunity to examine dynamics of galactic mergers. One question that arose was the nature of the devoured galaxy. It was largely assumed to be a dwarf galaxy—after all, NGC 5907 was not too badly disrupted, but that was an assumption that could be tested by determining the age of the stars left behind in the dust/star loops. Dwarf galaxies generally have small, old stars with low metallicities. Lane, et al. (2016) sought to analyze the metallicities of the stars left behind. They employed the Subaru/Suprime-Cam (SC). The Subaru scope sports a stunning 8.2 meter primary mirror. Their imaging, in the near infrared, targeted determining metallicity of the stars "along an ~60 kpc long segment of the stream."

At this point we depart from the focus of their study to examine a byproduct of it; namely, the extent of the loop(s) that they actually caught in their images.

Their images, though restricted to the brightest region of eastern loop, found only the same segment of a stream originally found by Shang, et al. (1998), which terminated shortly after a hook in the structure (Fig 4). They should have seen more of the loop, according to the image shown by MD, and in fact, where MD shows the loop to be brightest, they found no sign of the loop (Fig 4, right)! Probably because the geometry and extent of the loop was not of immediate interest to them, they made no comment on that fact that their observations did not appear consistent with the geometry or extent of the stream MD found.

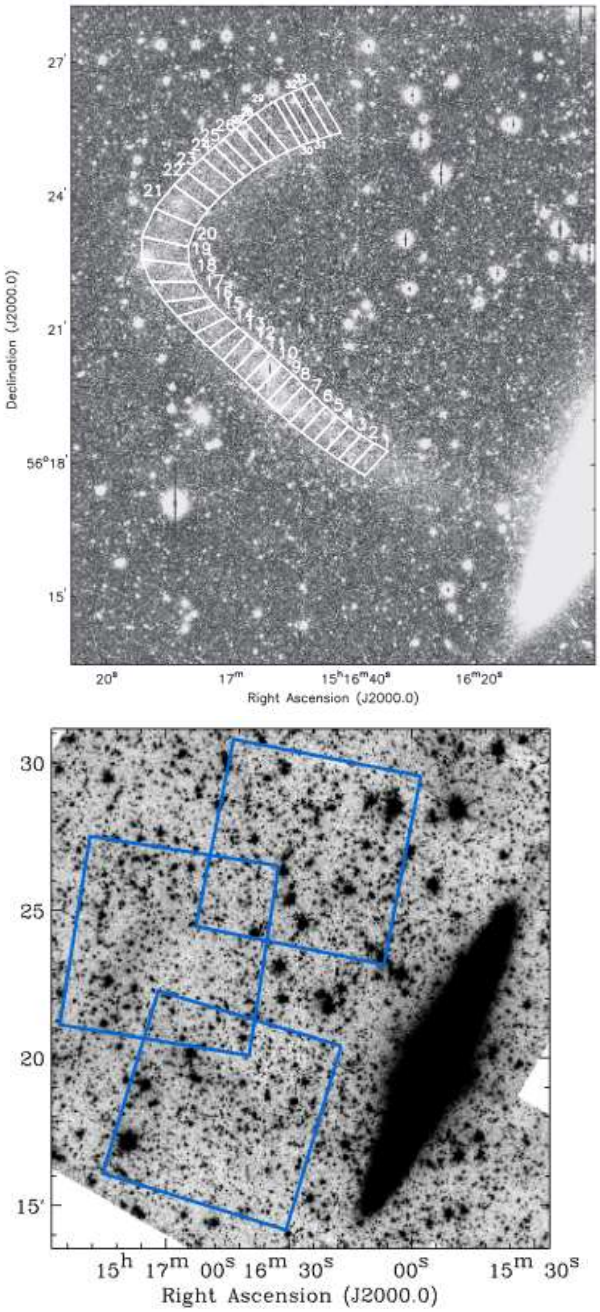


Fig 4 (top) The portion of the stream near NGC 5907 studied by Lane, et al. (2016). Note that beyond the hook, at the top of the image, no indications of the continuation of the stream appear. The extent of the stream in this image matches that observed by Shang, et al. (1998), but not that of MD. (Right) The areas (blue) examined in the Lane, et al. study. If the loop extended into the upper right box as indicated by MD, it should have been observed, but was not.

A (DRAGON)FLY IN THE OINTMENT: The Dragonfly Wide Field Survey instrument used by van Dokkum, et al. (2019) reaches far deeper, 30.3 mag/arcsed^2, than MD claimed for their image. But the images published by van Dokkum, et al. (2019) from the Dragonfly cameras "do not show two loops, but a single curved stream" with a surface brightness of about 27.6 to 28.8 mag/arcsec^2. Their improved imaging depth captured a faint portion of the stream not reached in previous images (Fig 5). Furthermore, van Dokkum, et al. found that where their image overlapped with that of MD the dust loop does not trace the same path in both images (Fig

6). Below, I will speculate on how this offset, brightness mismatch, and over-all geometry error may have occurred in MD's image. But first, one more nail in the coffin?

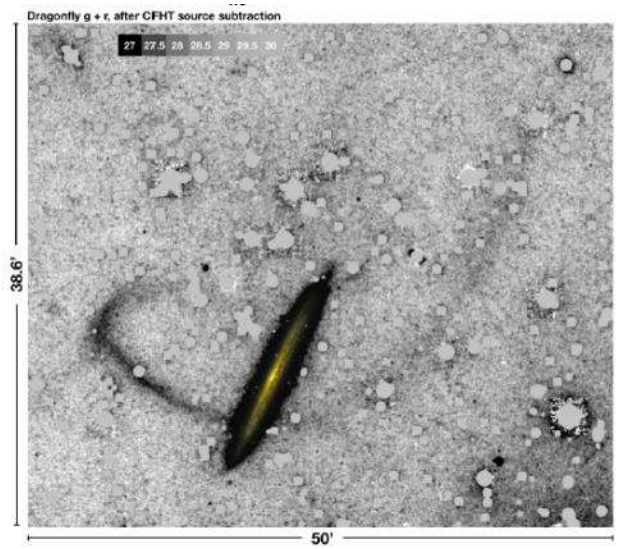


Fig 5. The Western Arm, faintly extending to the right of NGC 5907 had not previously been observed, due to its faintness. Image from Dokkum, et al. (2019). MD did not record this feature.

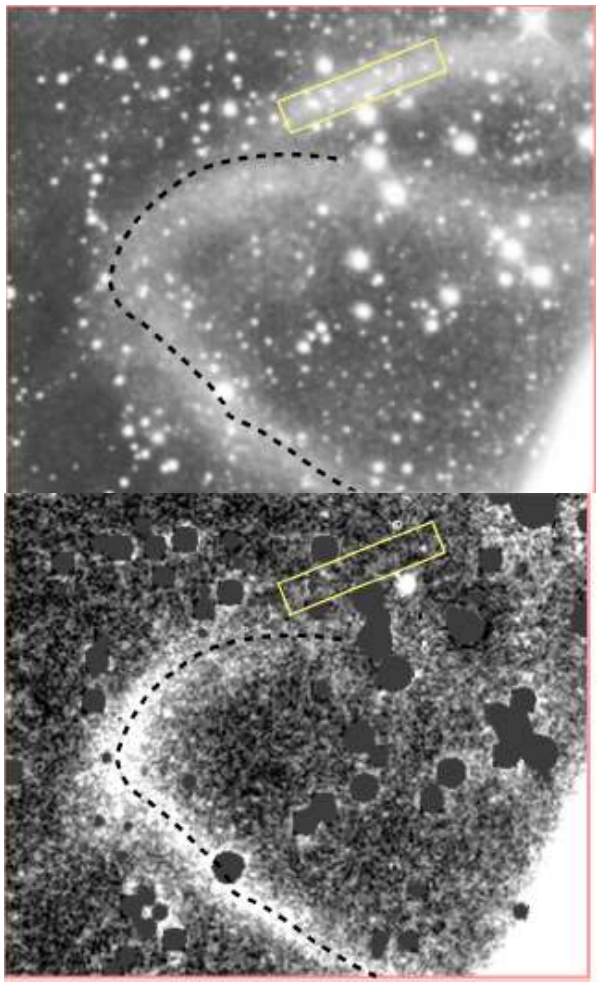


Fig 6. (Top) A portion of the image from Martinez-Delgado, et al. (2008) with the trace of the western loop's location as imaged with the Dragonfly array marked by the dashed line (and seen in the image on the right). The yellow box encloses the bright part of the loop as imaged by MD (left) compared to that same part of the field imaged by the Dragonfly array on the right. The observed differences exceed reasonable expected differences.

ANOTHER NAIL: Müller, et al. (2019) used a 1.4m telescope to acquire new images of NGC 5907 that reached down to 29.7 mag/arcsec^2. They found only the eastern short knee-bend streak, as already seen in previous surveys, but again, they did not observe the double loop reported by MD. See Fig 7.

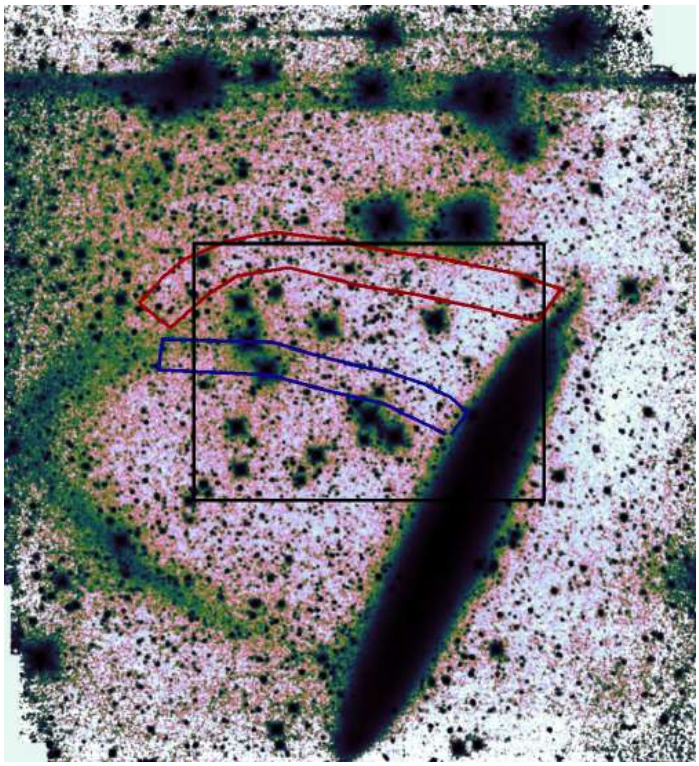


Fig 7. Image of NGC 5908 by Müller, et al. (2019) processed with histogram equalization and Gaussian blur, as was the image by MD. The closed shapes show parts of the stream identified by MD, but not observed by Müller, et al.

THOSE AGAINST TWO LOOPS, RAISE YOUR HAND: The evidence against the existence of the double loops seems over-whelming. However, van Dokkum, et al. (2019) notes, "…the fact that many amateur astronomers have repeatedly detected it" seems to support the existence of the loops. But do they? Consider one of the amateur images showing loops (http://www.photonhunter.at/NGC5907.html), which was taken with a 120mm refractor, and processed with Theli and Photoshop; this image repeats on another web page without attribution. As by Müller et al., "It seems that professionally handled data always yield a single stream, while data processed by amateur astronomers uncover more features." They also comment, "However, the data-reduction procedures adopted for the amateur images are not always transparent." I searched through the images of NGC 5907 on Astrobin and found several images showing indications of the single-loop feature documented by the professional astronomers, but only one image showed the double loops of MD. That image (6.2hrs of exposure using a 10" Newtonian reflector) also was processed in Photoshop.

(The reason I mention Photoshop is that it is not generally used for scientific-data reduction of astro-images, but is a popular tool among amateur astro-imagers.) Dokkum suggests that at least some of multi-loop conformational images taken by other amateurs used the image from MD as "template" and are not independent observations. The category.

THOSE FAVORING TWO LOOPS, RAISE YOUR HAND: I believe most rational, uninvolved people would think the issue resolved in favor of a single loop, but the MD team seems to want to persist. In a Sky and Telescope interview (2020), Martinez-Delgado criticizes the images from the 1.4m scope saying that some of them were obtained when the galaxy had a low elevation. As for the Dragonfly results, Trujillo says that their images were processed using a non-standard technique [which was rigorous and fully documented (Zhang, 2018)], and furthermore, that they did not reach the magnitude they claimed. (Yet they recorded parts of the dust trail too faint to be seen by MD?)

WHAT MAY HAVE HAPPENED: MD do not specify the program(s) used for their image reduction/enhancement. However, the two well-known amateur imager-processors among the authors, Gabany and Crawford, have a demonstrated affinity toward Photoshop for their astro-image processing. Both posted tutorials on the web showing how to paint masks to enhance local image detail (see references). If mask painting was used for the image analyzed in MD, that could explain the mismatch between the streak locations on the Dragonfly and Müller images and MD images (Figs 6, 7) as well as the now-you-see-it-now-you-don't extent of the loops. Perhaps mask painter was simply connecting the brighter dots and streaks according to what they believed to be a continuous path of the loops. Unfortunately, the amateur authors do not indicate either what image-processing programs they used or the details of their data treatments. Another possibility is some distortion in the calibration frames. Unfortunately, we cannot go back to the original data used in their discovery image because it was lost in a hard-disk crash and, again unfortunately, none of the six co-authors retained a backup copy (Sky and Telescope, 2020). Martinez-Delgado says that his team has follow-up observations in progress and will publish a response in a refereed publication soon.

Obviously, you can judge for yourself if multiple loops exist, but they appear only in data (of unknown mutual independence) from small scopes, while larger professional scopes show but a single loop. Personally, I find a single loop overwhelmingly more plausible.

Obiter Dictum: In my opinion, most amateur-processed images target a pleasing, perhaps artistic, rendition and should not be expected to portray scientific fact unless explicitly said to do so by their author-- in which case, hand painted masks or touch-ups should be taboo and detailed description of the data handling should be the norm.

Thanks to Kent DeGroff for reading and suggesting improvements.

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UPDATE: I wrote this several months ago, but just last month an article was published in journal of the Astronomical Soc. Of the Pacific that also looked at this galaxy, greater detail, using the Dragonfly array and it too failed to see the complex looping reported by Gbany, et al.. I have not seen the promised rebuttal to the counter-observations—have you?

NASA Night Sky Notes

September 2020

This article is distributed by NASA Night Sky Network

The Night Sky Network program supports astronomy clubs across the USA dedicated to astronomy outreach. Visit nightsky.jpl.nasa.org to find local clubs, events, and more!

Summer Triangle Corner: Altair

By David Prosper

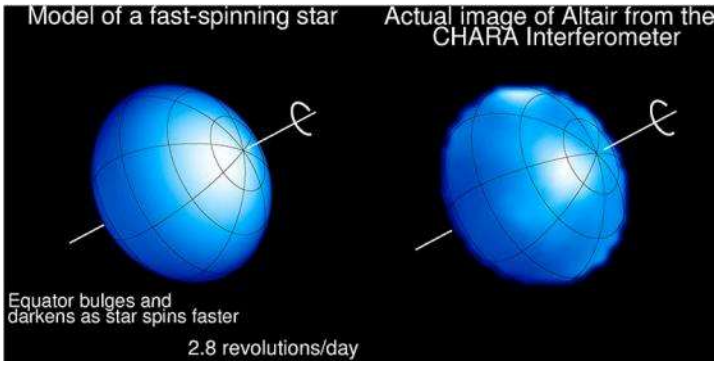
Altair is the final stop on our trip around the Summer Triangle! The last star in the asterism to rise for Northern Hemisphere observers before summer begins, brilliant Altair is high overhead at sunset at the end of the season in September. Altair might be the most unusual of the three

stars of the Triangle, due to its great speed: this star spins so rapidly that it appears "squished."

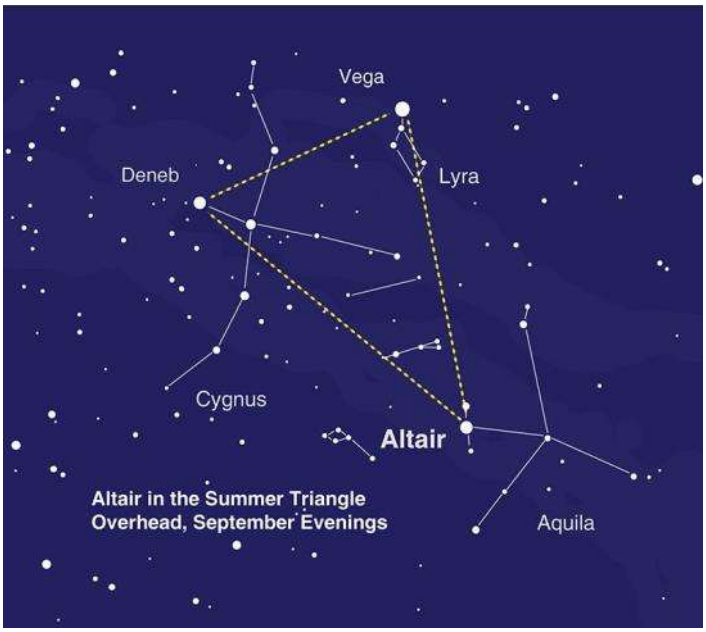
A very bright star, Altair has its own notable place in the mythologies of cultures around the world. As discussed in our previous edition, Altair represents the cowherd Niulang in the ancient Chinese tale of the "Cowherd and the Weaver Girl." Altair is the brightest star in the constellation of Aquila the Eagle; while described as part of an eagle by ancient peoples around the Mediterranean, it was also seen as part of an eagle by the Koori people in Australia! They saw the star itself as representing a wedge-tailed eagle, and two nearby stars as his wives, a pair of black swans. More recently one of the first home computers was named after the star: the Altair 8800.

Altair's rapid spinning was first detected in the 1960s. The close observations that followed tested the limits of technology available to astronomers, eventually resulting in direct images of the star's shape and surface by using a technique called *interferometry*, which combines the light from two or more instruments to produce a single image. Predictions about how the surface of a rapidly spinning massive star would appear held true to the observations; models predicted a squashed, almost "pumpkin-like" shape instead of a round sphere, along with a dimming effect along the widened equator, and the observations confirmed this! This equatorial dimming is due to a phenomenon called *gravity darkening*. Altair is wider at the equator than it is at the poles due to centrifugal force, resulting in the star's mass bulging outwards at the equator. This results in the denser poles of the star being hotter and brighter, and the less dense equator being cooler and therefore dimmer. This doesn't mean that the equator of Altair or other rapidly spinning stars are actually dark, but rather that the equator is dark in comparison to the poles; this is similar in a sense to sunspots. If you were to observe a sunspot on its own, it would appear blindingly bright, but it is cooler than the surrounding plasma in the Sun and so appears dark in contrast.

As summer winds down, you can still take a Trip Around the Summer Triangle with this activity from the Night Sky Network. Mark some of the sights in and around the Summer Triangle at: bit.ly/TriangleTrip. You can discover more about NASA's observations of Altair and other fast and furious stars at nasa.gov.



The image on the right was created using optical interferometry: the light from four telescopes was combined to produce this image of Altair's surface. Image credit: Ming Zhao. More info: bit.ly/altairvsmodel



Altair is up high in the early evening in September. Note Altair's two bright "companions" on either side of the star. Can you imagine them as a formation of an eagle and two swans, like the Koori?

Pictures from HAC Members

Mars by David Roemer

Comet Neowise and M53 by JD

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HAC Aug/Sep Calendar of Events

SU	MO	TU	WE	TH	FR	SA
6 Sep Mars 0.03 degrees S of Moon	**7** **ALL IN-PERSON EVENTS ARE**	**8** **SUSPENDED INDEFINITELY**	**9** Mars stationary	**10** **2:26 AM**	**11** Neptune at Opposition	**12** Jupiter Stationary
13	**14**	**15**	**16**	**17** **4:00AM**	**18**	**19**
20	**21**	**22**	**23** **6:55PM**	**24**	**25** Jupiter 1.6 deg N of moon. Saturn 2 deg N of moon	**26**
27	**28**	**29**	**30**	**1 Oct** **2:05 PM**	**2** Mars 0.09 degrees N of moon	**3**
4	**5**	**6**  Mars closest approach	**7**	**8** Draconid meteors	**9** **5:40PM** Draconid meteors	**10**
11	**12**	**13**  Mars at Opposition	**14**	**15**	**16** **12:30PM**	**17**
18	**19**	**20** O-Rex Sample Attempt Orionid meteors	**21** Orionid meteors	**22** Orionid meteors	**23** **6:23AM**	

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