This month our club hosts the Annual Astronomical League Convention, July 26-29, see Page 5 for details.-

Monthly Meeting July10th at 7:00 PM, in person

You may also join this meeting via meet.jit.si/BRASMeet

(Monthly meetings are held on 2nd Mondays of the month, at Highland Road Park Observatory)

PRESENTATION: **Dr. Penny of LSU will talk about the latest theory around the creation of the material universe from the Big Bang through the creation of the Solar System and beyond.**

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What's In This Issue?

Like this newsletter? See PAST ISSUES online back to 2009
Baton Rouge Astronomical Society Facebook Page
BRAS YouTube Channel – Monthly Speakers via Jitsi

President's Message

Well, folks, after a lot of hard work, seemingly endless meetings, negotiating, arm twisting, and even occasional head scratching, the time has arrived and the crunch is on for our club to deliver a spectacular ALCON convention. I can't overstate the trust that has been placed in us, and I am counting on your desire to help BRAS deliver an informative and memorable experience to registrants from all over the USA. By the way, if you haven't yet registered, please do your part to support your club, and your city. You have until July 11th to sign up for the Saturday night dinner with David Eicher. SE Registration Deadlines list on Page 3 This is your chance to attend an ALCon "on the cheap" (that is, without room rentals since you can go home at night) – there has not ever been an ALCON held in our neck of the woods – the closest one to us was in Dallas many years ago. We have a great line-up of speakers and events (watch the video on Page 5). Where else could you see and hear these speakers? Do not miss attending this event!

FYI, BRAS has met the 15% membership requirement per the contract that was signed with AL, but I want to see a large percentage of our membership registered for ALCon 2023 – let's show the country our enthusiastic support for Amateur Astronomy!

OTHER BUSINESS: The laptop computer (for outreach and astrophotography) information has been given to Trey along with the information on the streaming equipment (microphones, cameras, controller, cables, etc.). We plan to have everything set up so pushing only one button on the controller will connect everything for live streaming of the meetings and anything else BRAS might want to stream.

Discussions are ongoing for a permanent Webmaster. Michele has volunteered to do some basic updates on the website until we can designate a permanent person. If we can't get a member volunteer, BRAS will probably have to start paying for a Webmaster (on demand only). We will keep you informed on the progress of acquiring a permanent Webmaster.

Calendar of Upcoming Meetings

Monthly Member Meeting – 7 pm Monday, July 10th at the Observatory, in person and via Jitsi

Light Pollution Committee: 6 p.m. before the Monthly meeting.

Monthly Business Meeting: 7 pm Tuesday, July 25th (last Tuesday of the month due to ALCON beginning Wednesday - Members Only), at the Observatory, in person and via Jitsi

MOON (Members Only Observing Night) TBA

ALCon 2023 ("Astronomical Gumbo") Committee Meetings
Sundays at 7,, online.
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Clear Skies and Happy 4th of July!

John R. Nagle

Monthly Meeting Minutes – June 12th

- John introduced the speaker, Zachary Yarbrough, who talked about the history, development, and the current state of gravity wave research.
- Ben talked about outreaches.
- Steven gave an update on ALCon 2023.
- John discussed getting the Light Meter calibrated.
- John discussed our club's vote for the ballot for the AL By-Law changes and the election of an AL Secretary.
- A raffle was held for books and a calendar. More books were donated for future raffles.
-

Submitted by John Nagle,

Happy 4th of July, everyone.

I hope you all enjoy a huge helping of "Astronomical Gumbo at AL-CON" ~ *Michele*

Here are the Registration Cutoff Dates:

- ❒ MAIL IN REGISTRATION CLOSES JULY 3
- ❒ Bus signups and T-Shirt orders cutoff date is July 4, 2023
- ❒ Room Reservation Cutoff date is July 11
- ❒ *ON-LINE REGISTRATION IS NOW OPEN (closes July 24)
- ❒ Early bird REGISTRATION Cutoff for Food orders,(Box Lunches, Star-B-Que dinner, and Award Banquet is by end of the day July 17, 2023
- ❒ Members can pay just for Evening Planetarium show&Fred Espenak talk
- ❒ Members can pay just for the Astronomical Gumbo BBQ at HRPO. (Members not eating/drinking may attend HRPO event for free).
- ❒ Members can pay just for the annual Astronomical League dinner to honor awards recipients, which will help us meet our food and beverage obligation.

*Registration ends two days before the event so we can plan food and beverage for participants.

2023 Officers:

President: John Nagle
president@brastro.org
VP: Joel Tews
vice-president@brastro.org
Secretary: Roz Readinger
secretary@brastro.org
Treasurer: Trey Anding
treasurer@brastro.org

BRAS Liaison for BREC:
Chris Kersey
BRAS Liaison for LSU:
Greg Guzik

Committees/Coordinators:
al_awards@brastro.org
Merrill Hess
lightpollution@brastro.org
Open
newsletter@brastro.org
Michele Fry
observing@brastro.org
John Nagle
outreach@brastro.org
Ben Toman
public_relations@brastro.org
Scott Cadwallader
webmaster@brastro.org
Open

Business Meeting Minutes – June 28th

(meeting is the last Wednesday of the month, in person, at HRPO.

1. Laptop & Video equip. – John forwarded the email from Ben with Ben's information to Trey; Trey will check for this later this evening. There was an attempt to order, but item(s) was/were out of stock. We are also looking to get an Office Depot coupon in order to receive a reduction in price.
2. AL Ballot – There are two changes to the AL bylaws related to transparency that the club will need to vote on. One relates to contracts and the other has to do with what groups get to bid on hosting ALCON. Also, the current secretary for the Astronomical League is running for reelection unopposed. So, there will be a vote for all this at the July BRAS meeting; John will send the result to the Astronomical League afterwards.
3. AVX hand controller – This is currently on back order.
4. ALCON – We finished the meeting with this item. There was a discussion about getting the Star-B-Q caterer, BREC, and paperwork all connected; Joel was given a phone number the caterer could use to contact Darryl Hughes at BREC. We determined we needed a couple of canopies for the Star-B-Q; this will entail a work order to BREC. The deadline for the buses for LIGO and Landolt is Monday, July 3rd. Registration will remain open at the current rates through the end of the convention on July 29th. There will be a final walk-through meeting at the hotel this Friday, June 30th, starting at 9:30 am. There was some discussion about graphics for new flyers for the club; these would be printed on high glossy paper front and back. Steven showed a picture of the lapel pin that will be included in everyone's registration tote bag. There will be a set of donated binoculars that will be raffled off during the convention. Lanyards and badge holders will be ordered from Office Depot. We still need letters from various people before we can get the programs printed. The next ALCON meeting will be Sunday, July 2nd, at 7:00 pm at the observatory and online.
5. Website – Michele has not made changes, but she does have the permission she needs to do this. She has the password and is able to make basic changes but is not up on current design trends. After the date in the heading of the newsletters is changed, Chris K. requested that all the newsletters be uploaded to the website.

New Items

Because of the ALCON convention next month, the BRAS monthly business meeting has been rescheduled for Tuesday, July 25th, at 7:00 pm at the observatory.

Members attending this evening were John N., Joel T., Scott C., Chris K., Steven T., Trey A., and Roz R.

Submitted by Roz Readinger, Secretary

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BRAS subreddit and a Discord server.

Our subreddit has been set up for us to reach out to the public. Please join us on there. **https://www.reddit.com/r/BRAstro/**

Our Discord server is for Members only, and requires the download of a free app. It's a fun place for us to hang out. **T**o join the discord, email **safey2007@gmail.com** with the subject **BRAS Discord**.
To add a Flair next to your username, PM Amy Northrop.

.For Discord help, access **techsupport-faq**,
or message Amy orJustin: **https://discord.gg/6N8r8DDj**
It also has voice channels so that you can speak to people through Discord.

The best part about both of these is that you can access them on your phone with the free apps. Hope to see you there. ~ Amy Northrop

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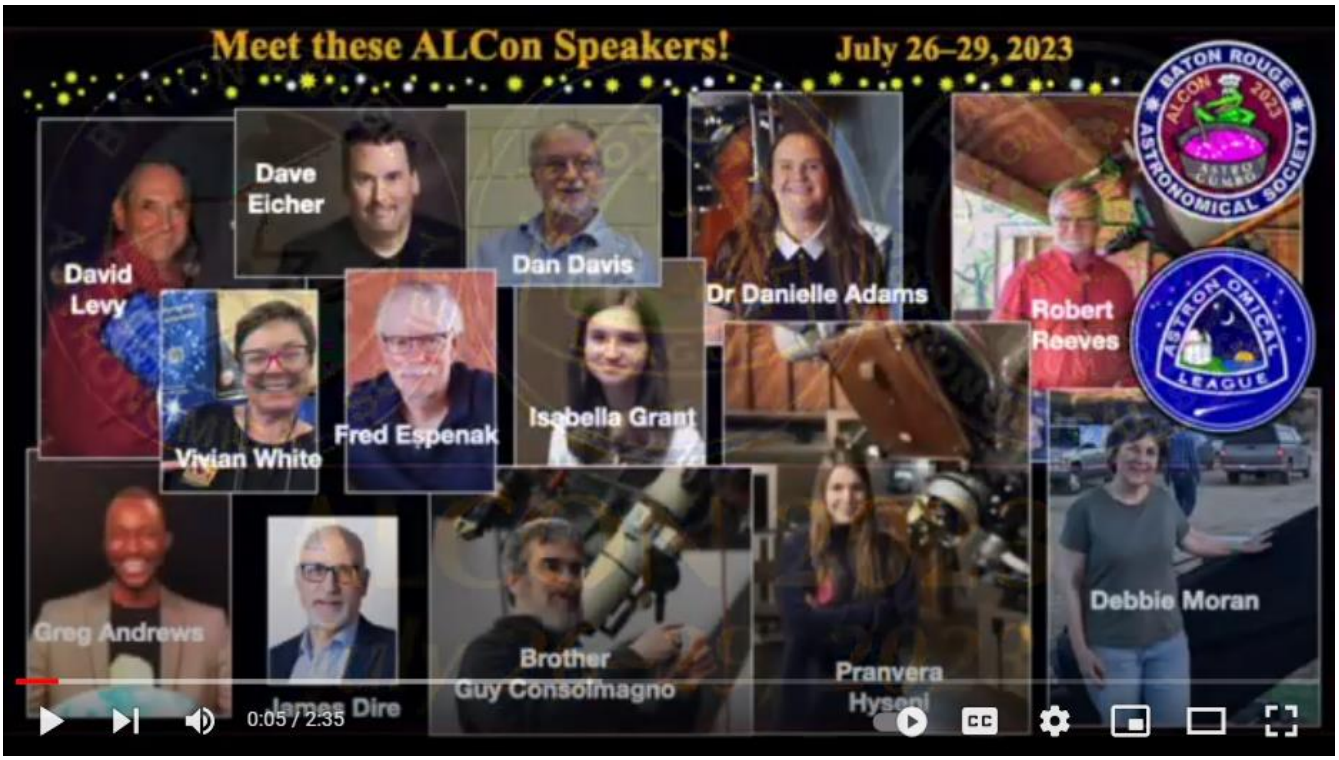
Shame on you if you haven't joined the ASTRONOMICAL LEAGUE FACEBOOK PAGE, where they are posting all kinds of fascinating information about our upcoming convention like room rental rates, ways to earn badges, astronomy projects, and here's one entry:

MEET THE ALCon SPEAKERS! Click on the photo to watch the video.

become a member, keep up with the news, be part of the conversation.



https://www.facebook.com/Astronomical.League/

Outreach Report for June 2023

Hi Everyone,

First of all, thanks to Chris R., Scott C. and Troy for braving the blistering heat and helping out with our two outreach events we had this past month. (The event we did on June 30th will go down as the hottest Outreach ever! We are committed to Outreach, but maybe we should be committed to a local asylum!!)

Now, for the REAL ***hot topic of the month...ALCON 2023*** here in Baton Rouge. We need as many hands on deck as possible to help with this mainly so nobody gets stuck doing all the work and everyone gets a chance to enjoy the convention. You have already received the (very) detailed 1st call for volunteers. Please see the summarized list below and let me know ASAP if you are available to help out at all. (Even if it's just to sit at the Registration desk for an hour!)
For more details on this stuff, check out the last email I sent out to everyone. It has the breakdown of **who/what/when and where.**

ALCON 2023

Wednesday, July 26th
11am-10pm
(Registration Desk, Ushers at LSU in the evening)

Thursday, July 27th
7am-10pm
(Registration Desk, Ushers for various Sessions, Ushers for visit to LASM)

Friday, July 28th
7am-10pm
(Registration Desk, Ushers for various Sessions, Ushers and Setup/Cleanup at HRPO)

Saturday, July 29th
7am-10pm

Scott had his hands full at our table during the Summer Reading Kick-off at the Main Library on June 1st! Also, Ben talked about the Solar System, Chris helped some patrons view the Sun. Lots of interested people out at the Library!!

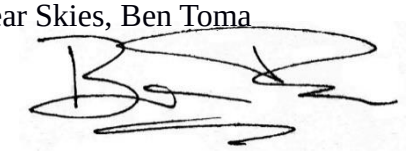
Our setup for some Solar Observing on June 30th at Grace Life Fellowship. We each went through several bottles of water!!

(Registration Desk, Ushers for various Sessions, Ushers for Banquet dinner at hotel)
We will also be stuffing the bags of goodies for all of the participants at some point in the near future….the week before the convention at the latest. If you would like to assist with that, just let me know and we'll get back with you as soon as a date/time are set for it.

This should be a fun experience, but it'll be a lot less stressful if we have plenty of helping hands. Thank you so much to those that have already replied with your availability to the previous email. Things are starting to come together!

Finally, if you did NOT receive the "Call for Volunteers" email for ALCON, let me know and I'll resend it to you.

Clear Skies, Ben Toma



LPC (Light Pollution Committee) Report June)

This committee meets at 6:00, same day as the 7:00 BRAS Member Meeting
Everyone is welcome to join in.

1. Form letter for new construction/projects is still being worked on – the letter has been outlined but will need to be tailored for the individual circumstances. If you see any new construction, try to get the name of the companies involved, and please let the committee know about it.
2. There is a section of the UDC (Unified Development Code – it takes the place of Ordinances) on measurement of light for possible violations that needs to be clarified. There has been an e-mail sent to the UDC Committee for clarification.
3. Chris is handling complaints HRPO has received about lighting on roads to the DOTD.
4. Scripts for LP on the BRAS You Tube channel are being written – the first will be a basic description of what LP is. If you would like to volunteer to be in a video on LP, please let us know.
5. Outreach in parks in North Baton Rouge – we will have to contact the supervisor for each park to set up an outreach event at that park. Discussed form letter for new construction/development. Letter should have 3 paragraphs on Light Pollution – one paragraph on Glare, Trespass, and Skyglow.
6. Light Meter needs to be calibrated.
7. Chris to meet with DOTD about complaints he has received over bright lights on roadways.
8. Videos on the BRAS You Tube channel – we have been informed that the River City library maker Space has a set-up for recording. We need volunteers to appear/read the scripts.
9. Outreach in North Baton Rouge parks – we will start with Solar viewing in August, and in the fall we will go to night viewing.
10. Entergy contact – still no response.
11. New Business
12. The IDA Southeast Regional group, Starry Skies South, has contacted me and I am attending their Zoom meetings.
13. We are checking into the LSU Campus Lighting project.
14. Entergy contact – Chris is contacting Entergy about LP concerns.

John Nagle, LPC Chair Pro-Tem

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Globe At Night

The target for the Globe at Night program is Boötes and Heracles from July 8th through July 17th

If you would like to participate in this citizen science program, you can find instructions ahttps://www.globeatnight.org

P.S. The "Loss of the Night" app can be used for information and for reporting your observations.

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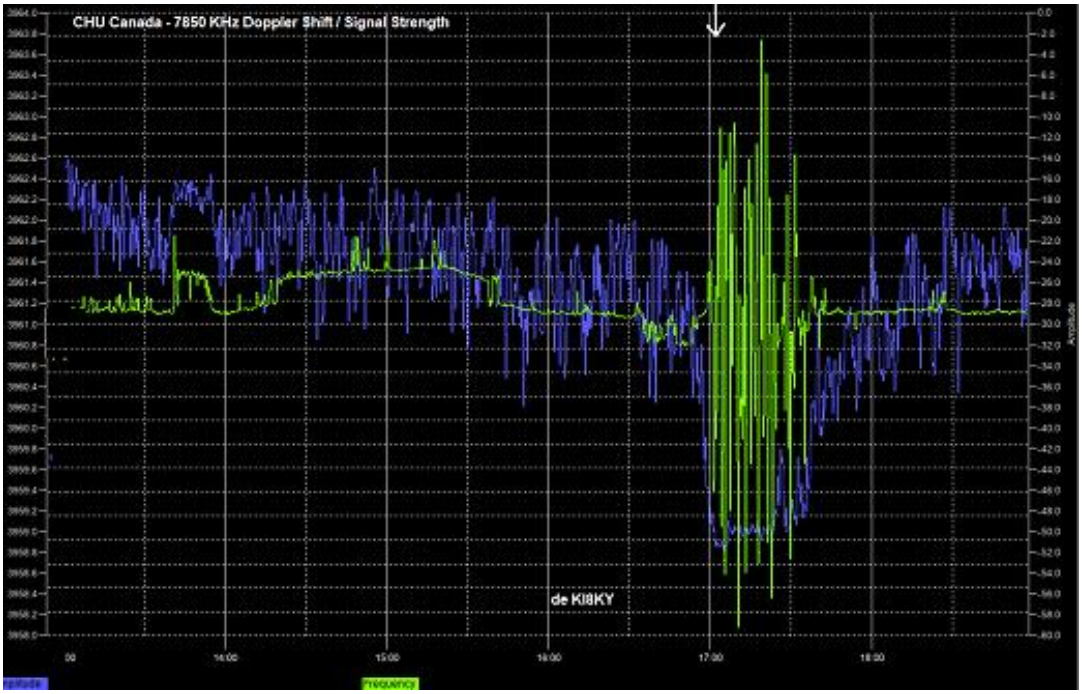
SPACE WEATHER ALERTS

Instant solar flare alerts: The sun is starting to flare again.
Sign up for Space Weather Alerts to receive text messages when explosions are underway.
Basic plan $49.95/year

Alerts include: Coronal Mass Ejections (CME), Geomagnetic Storms Predicted (class G1-G4), Planetary K-index (K5-K9, K4 for Pro Plan), Solar Flare alerts (X-Ray Flux levels and Scales), Solar wind speed alerts (500, 600, 700 and over 800 km/s), B Sub Z South-pointing episodes, Cracks in Earth's magnetic field.

GET YOUR HAM ON, you CITIZEN SCIENTISTS
Check out
"A NEW WAY TO DETECT SOLAR FLARES"

Around the world, ham radio operators are experimenting with a new way to detect solar flares--the Doppler Shift method. Brian Curtis of Sault Ste Marie, Michigan, demonstrated the technique during the June 20th X-flare:



"I monitor the frequency and field strength of Canada's CHU time station transmitting at 7850 KHz," explains Curtis. "During the X-class flare event, I was able to detect the Doppler shift of the station's carrier frequency (green plot). It shifted by 5 Hz, which is a small change, but very obvious!"

When radiation from a solar flare hits Earth's atmosphere, it ionizes the air, temporarily boosting the thickness of our planet's ionosphere. Any radio station skipping off the ionosphere will suddenly find its frequency Doppler shifted. Frequency standards stations such as WWV, WWVH, and CHU transmit carriers with atomic-clock grade frequency stability, so they are perfect sources for Doppler monitoring.

"I have been monitoring radio stations for decades, noting sudden changes in signal strength as a means of monitoring space weather events," says Curtis. "It is only fairly recently (~4 months) that I started to experiment with monitoring the Doppler shift of HF stations. Yesterday's X-class flare event is by far the most dramatic that I have witnessed thus far."

Would *you* like to detect solar flares this way? The HamSCI citizen science program has developed a Personal Space Weather Station specifically for doppler shift measurements. This technique can also be used to study solar eclipses.

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Messages from HRPO

Highland Road Park Observatory

2023 HRPO DONATION DRIVE

through 29 December / Goal: $2000.

Our annual fundraising drive has been successful for many years. The agreement (as always) is for the public to give us Drive money, as long as we say what we're going to buy, and it is for public program use!

SCIENCE ACADEMY

Saturdays from 10am to 12pm.
*for Cadets aged eight to twelve *$5 per Cadet per week ($6 if out-of-parish)*
walk-ins welcome, but advanced registration via WebTrac strongly recommended
*[activity #531990] * parents may stay with or leave Cadet*
Four Cadet minimum and sixteen Cadets maximum per session.

1 July = "Colonizing the Moon"
8 July = "Colonizing Mars"
15 July = "Expedition 3"
22 July = "Exploring Weather III"

EVENING SKY VIEWING

No admission fee. For all ages.
Saturday 1 July from 7:30pm to 10pm (viewing pads only)
Saturday 8, 15 and 22 July from 7:30pm to 10pm
Friday 14 and 21 July from 8:30pm to 10pm

HRPO houses a 50-cm reflector, a 40-cm reflector and several smaller telescopes to bring the majesty of the night sky to the public. Trained operators, sharing duties via a rotating roster, work throughout the year in shifts. Each operator has a pre-planned list of objects to highlight. However, requests will be taken if there is time and if all present have viewed the previous target.

EDGE OF NIGHT

Friday 7 July from 8pm to 10pm. / No admission fee. For ages six and older.

It's not light, it's not dark. It's that special time called twilight, and HRPO wants to introduce you to it! Are all sections of the sky the same shade of blue? Which stars are seen first? Are Mercury and Venus or the Moon out? Is that moving object a plane, a satellite or space debris? How much actual darkness should I expect in a light-polluted city when twilight has passed? There is no other time like twilight. Bring it into your life!

LIGHT POLLUTION COMMITTEE

Monday 10 July from 6pm to 7pm
for ages fourteen and older / no admission fee

BATON ROUGE ASTRONOMICAL SOCIETY MEETING

Monday 10 July from 7pm to 9pm
for ages fourteen and older / no admission fee

FRIDAY NIGHT LECTURE SERIES

7:30pm / For ages fourteen and older. / No admission fee.

14 July = "Wonders of the Summer Sky" The temperature heats up as July's constellations settle high overhead early in the night. BREC Education Curator Amy Northrop takes the audience on a fascinating tour of Baton Rouge's summer season. She highlights the celestial gems that will sparkle throughout the next three months—gems that visitors will be able to see live if they continue to visit HRPO!

21 July = "Submersibles" They are not as self-sufficient as a submarine but whether manned or robotic they provide a means to explore watery depths. This presentation will cover the history of submersible, describe the NASA antarctic mini-sub and provide the latest news regarding the Titanic dive tragedy.

PLUS NIGHT: "Demonstration Overload"

Saturday 15 July from 7pm to 10pm
for ages six and older / no admission fee / binocular recommended

During Plus Nights and extra features are available to the public…
*The well-known marshmallow roast takes place at the campfire ring (weather-depending).
*Six to eight of HRPO's collection of over fifty physical science demonstrations will be on hand to perplex and amaze. Which demos will it be?
*An unaided eye sky tour takes place, showing the public major features of the sky for that month.
*Filters are inserted into the viewing mechanisms, to show patrons "hidden" details of the Moon, Mars and Jupiter (when they are available).
*Reveal your age, and be shown any "birth stars" in the sky at that time.

SOLAR VIEWING

Saturday 22 July from 1:30pm to 3:30pm
for ages six and older / no admission fee

Weather permitting, viewing of the Sun's image in three different manners—transferred onto a white surface, directly with safely-filtered optical light, and directly in safely-filtered hydrogen-alpha wavelength—will take place for two hours. Protective clothing and sunscreen are recommended.

STEM EXPANSION: "Meteorology in Space"

Saturday 22 July from 3:30pm to 7:30pm
For ages twelve to sixteen. / $15 each per in-parish registrant; $18 each per out-of-parish registrant. Advanced registration via WebTrac required [activity #531993].

This program offers advanced topics, topic extensions and all-new games and activities to an older crowd. Certificates will be earned, and a section of archived experiments, some not seen in over fifteen years (and some *never* performed on site) take place. There are also giveaways and door prizes.

LUNAR EXPLORERS CAMP

24 July to 28 July / 8am to 5pm daily. For ages eleven to thirteen.
$125 per EBR-parish camper / $150 per other-parish camper
[Cost covers entire session; limit thirty per session.]

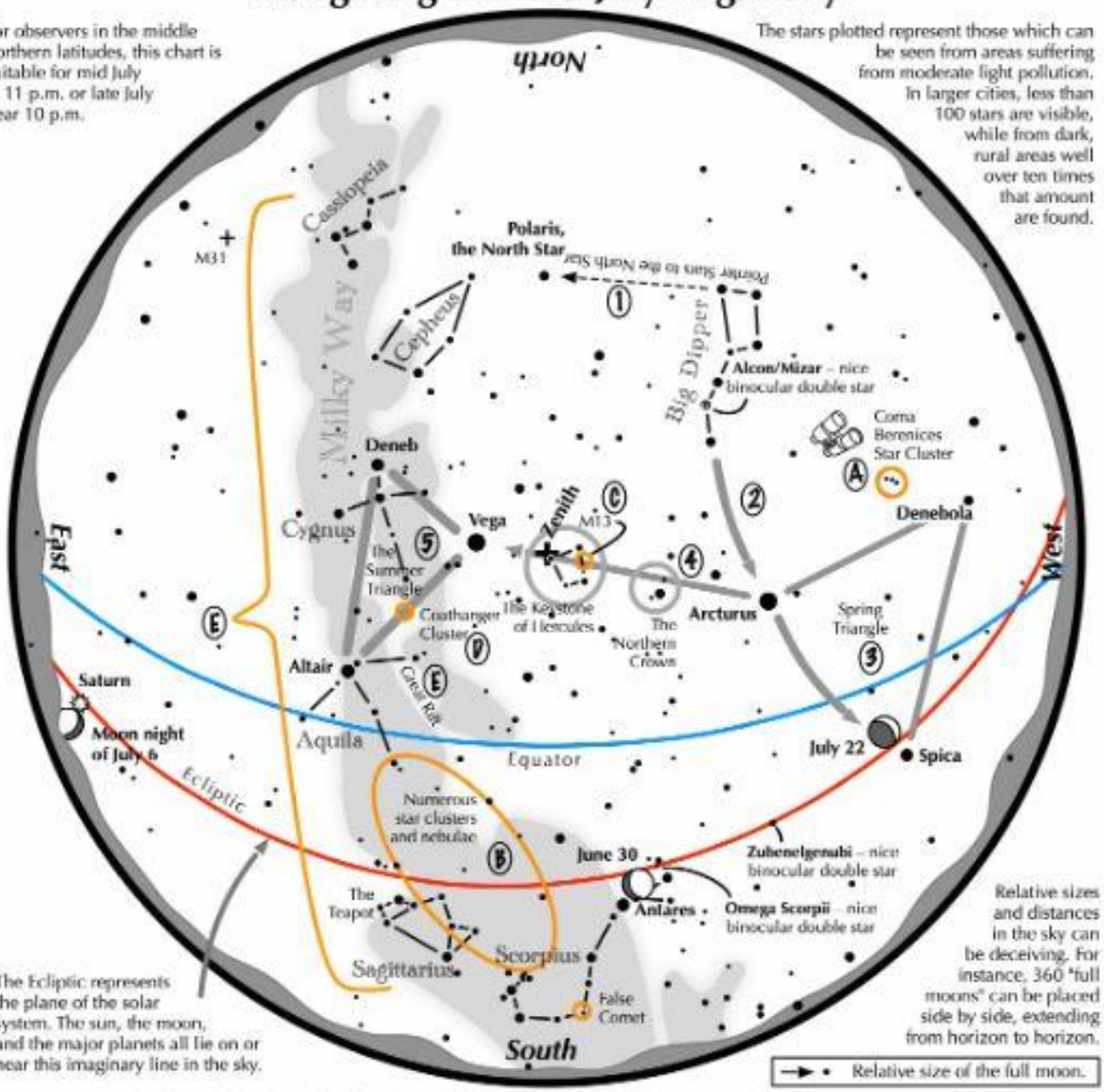
This one-week-only session focuses on Earth's sole natural satellite. Campers will design and build a Moon colony, get immersed in the Mercury/Gemini/Apollo era and get the latest scoop on the Artemis mission. There will be special guests to provide Earth gem and minerals to contrast what may be mined on our Moon. Parents may register in person at HRPO or online at Webtrac. The activity number is 231180.

DISPLAY RETURN:

"Free to Wonder, Free to Ask, Free to Hear, Free to Decide"
Monday 31 July to Saturday 28 October

Without the backing of the United States Constitution and Bill of Rights—and an understanding of their purpose—neither scientists nor amateurs nor anyone could wonder about things, then ask questions, then hear all sides, then make a decision. This display returns for three months!

Navigating the mid July Night Sky



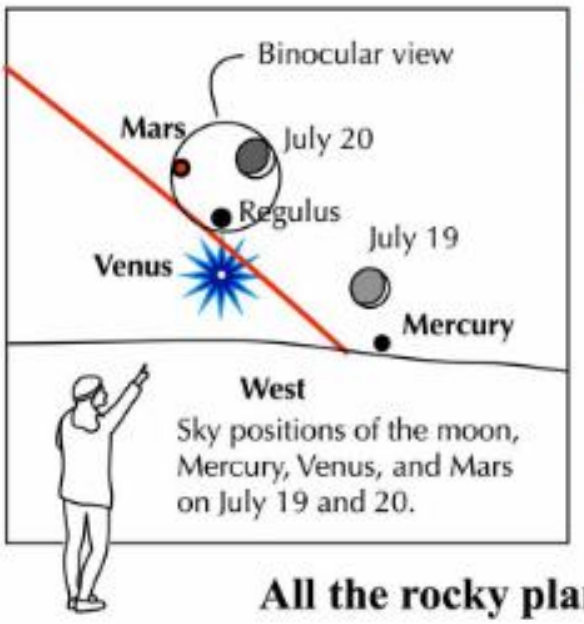
Navigating the mid July night sky: Simply start with what you know or with what you can easily find.

1. Extend a line north from the two stars at the tip of the Big Dipper's bowl. It passes by Polaris, the North Star.
2. Follow the arc of the Dipper's handle. It first intersects Arcturus, the brightest star in the July evening sky, then continues to Spica. Arcturus, Spica, and Denebola form the Spring Triangle, a large equilateral triangle.
3. To the northeast of Arcturus shines another star of similar brightness, Vega. Draw a line from Arcturus to Vega. It first meets "The
4. Northern Crown," then the "Keystone of Hercules." A dark sky is needed to see these two dim stellar configurations.
5. High in the East lies the Summer Triangle stars of Vega, Altair, and Deneb.

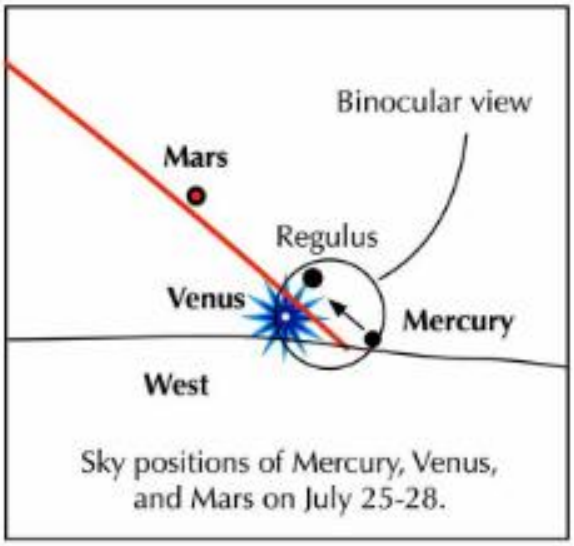
Binocular Highlights

A: Between Denebola and the tip of the Big Dipper's handle, lie the stars of the Coma Berenices Star Cluster.
B: Between the bright stars Antares and Altair, hides an area containing many star clusters and nebulae.
C: On the western side of the Keystone glows the Great Hercules Cluster, containing nearly 1 million stars.
D: 40% of the way between Altair and Vega, twinkles the "Coathanger," a group of stars outlining a coathanger.
E: Sweep along the Milky Way for an astounding number of faint glows and dark bays, including the Great Rift.

If you can see only one celestial show in the evening this July, see this one.



Sky positions of the moon, Mercury, Venus, and Mars on July 19 and 20.

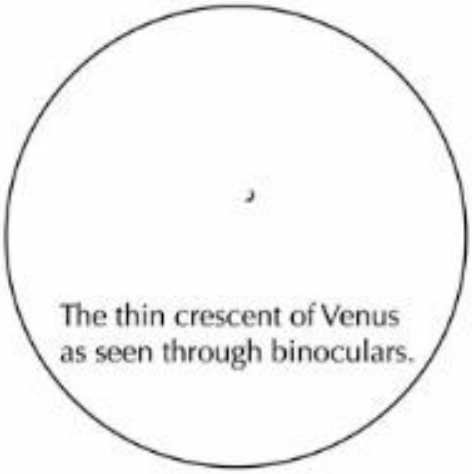


Sky positions of Mercury, Venus, and Mars on July 25-28.

All the rocky planets, all at once!

On the evenings of July 19 and 20, look towards the west 30 minutes after sunset.

- Brilliant Venus will be seen as a tiny crescent in steadily held binoculars.
- On the first evening, the thin crescent moon, full with earthshine, hangs above Mercury. The little planet might be lost in the bright twilight.
- On July 20, the moon forms a triangle with Regulus and Mars. Venus sinks below them. Mars, having lost its splendor from last fall, might be difficult to spot in the bright twilight. Binoculars will help.
- Mercury climbs somewhat higher over the remaining evenings in July. On July 28, it lies directly next to Regulus, which has dropped much closer to the horizon. Venus may lie too close to the horizon to be spotted. Because of their low alittude, very clear skies and a low horizon are needed to see this.


The thin crescent of Venus as seen through binoculars.

OBSERVING NOTES JULY

Cassiopeia – The Queen Of Ethiopia

Position: RA 00.0, Dec.+60°

Note: For six years I wrote these Observing Notes, featuring the 60 constellations we can see before midnight from Baton Rouge, containing objects above magnitude 10. For the next three years I expanded that information and put all my research in the same format, ending last April, 2022. Beginning with last May, Named Stars, Deep Sky and Other Stars are expanded to include new discoveries, and updated when more accurate information is available. Monthly updates will be made to Sky Happenings and all that appears below that title.

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Named Stars

Scheder (Alpha Cas), from the Arabic "al-sadr" – "breast", also called Shedar, Shedir, and Seder, mag. 2.24, 00 40 30.39 +56 32 14.7, is an orange giant star. The WDS says there are three companions – optical only. There is a 9th magnitude, widely separated, companion that is bluish or pale white at a separation of 63"; there is a second fainter companion, at magnitude 12.7, at a separation of 38" at PA 38°; and there is a third companion, magnitude 13.7, at a separation of 20" at PA at 275°. Also known as **HD 3712**, **HIP 3179**, **HR 168**, and **18 Cassiopeiae**.

Caph (Beta Cas), from the Arabic "al-Kaff al-Khadip" – "the Stained Hand", or from "Al Sanäm al Näkah" – "the Camel's Hump", mag. 2.28, 00 09 10.09 +59 09 00.80, is a yellow-white sub-giant star and a rapid rotator (72.4 km/second). The ADS says it is a spectroscopic binary star with a period of 27 days. WDS says it has one companion at magnitude 12.4 with a separation of 66" at PA 268°. There is another companion at 14th magnitude with a 23" separation. **Cassiopeia A** is 6° to the west. Also known as **HD 432**, **HIP 746**, **HR 21**, and **11 Cassiopeiae**.

Tsih (Gamma Cas), from the Chinese for "whip", also called "Navi" – named so by Gus Grissom – it is his middle name (Ivan) spelled in reverse, mag. 2.47, 00 56 42.50 +60 43 00.30, is a Be type sub-giant variable star (the first star to be classified as a type e for emission) with bright hydrogen lines, a visual double star, an X-ray source (**MX 0053+60**), and a rapid rotator (422 km/second) with a 211 day rotation period. The secondary star in the binary has a rotational period of 204 days. There are two companions: an 11th magnitude dwarf star at 2.2" separation; and a 12.9 magnitude sub-giant star at 54" separation. Two nebulae surround **Gamma Cassiopeiae** – **IC 59** at 25.7' to the north and **IC 63** at 22.7' to the northeast. Also known as **HD 5394**, **HIP 4427**, and **27 Cassiopeiae**.

Ruchbah (Delta Cas), from the Arabic for "the knee of the Lady of the Chair", also called "Rucha" or Rucbar" from the Arabic "al Rukbag" – "the knee" and sometimes called "Ksora", mag. 2.68, 01 25 48.60 +60 14 07.50, is a blue-white eclipsing binary star with a period of 795 days and is a borderline giant star. There is a 12th magnitude companion. Also called **HD 8538**, **HIP 6686**, **HR 403**, and **37 Cassiopeiae**.

Segin (Epsilon Cas), mag. 3.35, 01 54 23.68 +63 40 12.5, is a blue-white giant Be-type star at the end of its hydrogen fusing cycle and is notable for showing extremely weak spectral absorption of helium. It is a slow rotator – 19 km/second – and a shell stat. Also known as **HD 11415**, **HIP 8886**, and **45 Cassiopeiae**.

Fùlù (Zeta Cas), or "Fooloo" from the Chinese for "a by-path", mag. 3.69, 00 36 58.27 +53 53 49.00, is a blue-white sub-giant star and a **SPB** (slow pulsing B-type star) variable star and the first one of its kind discovered to have a magnetic field. Also known as **HD 3360**, **HIP 2920**, and **17 Cassiopeiae**.

Achird (Eta Cas), mag. 3.46, 00 49 05.10 +57 48 59.60, is a visual binary star with a period of 479.27 years. The primary is a yellow-hued main sequence dwarf eruptive variable star, and the secondary star

is an orange-hued dwarf star at magnitude 7.5 having a separation of 5" to 16" (36 to 106 au – mean separation is 68 au). The WDS says there are 8 companions – all appear to be optical companions. Also known as **HD 4614**, **HIP 3821**, **Σ 60**, **ADS 671**, and **24 Cassiopeiae**.

Marfak (Theta Cas), from the Arabic "al Marfik" – "the Elbow", also "Marfark", and sometimes called "Marfak East", mag. 4.34, 01 11 05.93 +55 08 59.80, is a rapid rotator (103 km/second) and has a rotational rate of 1.3 days. The WDS says it is a spectroscopic binary star and that two companions are probably an optic pair only. Also known as **HD 6961**, **HIP 5542**, and **33 Cassiopeiae**.

Marfak (Mu Cas), from the Arabic "al Marfik" – "the Elbow", also called "Marfak West", mag. 5.17, 01 08 12.92 +54 55 27.20, is a spectroscopic binary star with a 22-year period. The secondary star is magnitude 11.5 – a red dwarf star – at a separation of 7 au. The primary has an unusually low metal content. Located 28' west-southwest of **Theta Cassiopeiae**. Also known as **HD 6582**, **HIP 5336**, **BD+54 233**, and **30 Cassiopeiae**.

Castula (Upsilon² Cas), mag. 4.62, 00 56 40.01 +59 10 52.20. Also known as **HD 5395**, **HIP 4422**, and **28 Cassiopeiae**.

Pearce's Star (AO Cas), mag. 6.11, 00 17 43.07 +51 25 59.10, is a rotating ellipsoidal variable binary star. Both are giant "O" type stars, revolving and almost touching each other with a period of 3.52355 days, and a computed separation of 15 million miles. It is one of the most massive and luminous stars known – the secondary is the larger star. It is a double-lined eclipsing binary and a modest X-ray source. Its peculiar radial velocity of 31 km/second in recession makes it a candidate for a run-away star. The star is surrounded by **vdB 6**. Also known as **HD 1337**, **HIP 1415**, and **Boss 46**.

Osawa's Star (HD 221568), mag. 7.55, 23 32 47.60 +57 54 20.10, is a variable star. Also known as **HIP 116210** and **V436 Cassiopeiae**.

Nushagak (HD 17156), mag. 8.7, 02 49 44.49 +71 45 11.60, has a confirmed transiting planet at a separation of 1.16 au and an orbital period of 501 days. It also has one unconfirmed planet in orbit. Also known as **HIP 13192**.

Tycho G, mag. 17.0, 00 25 19.90 +64 08 18.00, is a red sub-giant star with a radial velocity of 80 km/second and is the former companion to the progenitor of **SN 1572** (**Tycho's Star**).

Deep Sky:

M52 (NGC 7654), mag. 6.9, 23 24 12 +61 35 00, 20'x12' in size, 200 stars, is an open cluster that is detached, strong concentration of stars; moderate range in brightness; large. It is located 1° south and slightly west of the 5th magnitude star **4 Cassiopeiae**. **NGC 7635** (**The Bubble Nebula**) is 36' to the southwest. On the west-southwest fringe is the star **SAO 20606** (**BD+60 2532**, magnitude 8.3). Also known as "**The Cassiopeia Salt and Pepper Cluster**", **Cr 455**, **Mel 243**, and **OCl 260.0**.

M103 (NGC 581), mag. 7.4, 01 33 24 +60 39 00, 12'x5' in size, 172 stars including **Σ 131**, and is in the **Cassiopeia OB8 Association**. The cluster is detached, no concentration of stars; modest range in brightness; magnitude of brightest star (**HD 9311** – a red dwarf star) is 7.3; fan shaped. The central star is **BD+59 276** (**SAO 11826**) and 1' south of it is **BD+59 273** (**SAO 11824**) and **HD 9635** (**BD+59 276**). The triple star **ADS 1209A** is on the northwest edge. On the southwest edge is **NGC 659**, **654**, and **663**. Also known as **OCl 326**, **Cr 14**, and **Mel 8**.

St(ock) 2, "The Muscle Man Cluster", mag. 4.4, 02 14 43 +59 29 06, 60' in size, 166 stars, is an open cluster that is detached, strong concentration of stars; moderate range in brightness; magnitude of brightest star is 8.2. Located 2° north of the **Double Cluster** in **Perseus**. Also known as **Lund 71**, **OCl 348**, **OCl 348.0**, and **C0211+590**.

Cr (Collinder) 463, mag. 5.7, 01 45 45 +71 48 36, 57' in size, 79 stars, is an open cluster that is detached, no concentration of stars; moderate range in brightness; magnitude of brightest star is 8.5. Also known as **Lund 57**, **OCl 324**, **OCl 324.0**, and **C0144+717**.

IC 1805 "The Heart Nebula", mag. 6.0, 02 32 50.4 +61 28 16, 60'x60' in size, 62 stars, is a faint, very large patch of nebulosity surrounding a large (20' in size) open cluster that is detached, no concentration of stars; large range in brightness; magnitude of brightest star is 7.8. The central star is

HD 15558 at magnitude 7.8. The cluster is located within **Mel 15** and is part of the **Cassiopeia OB6 Association**. Located 5° east-southeast of **Epsilon Cassiopeiae**. Also known as "**The Running Dog Nebula**" (with **IC 1795**), **Cr 26**, **Lund 81**, **Mel 15**, **OCl 352**, **Raab 1**, **Mrk (Markarian) 7**, **RAFGL 333**, **SH2-190**, **NRL 15**, **LBN 645** (**IC 1795**), **LBN 654**, **LBN 134.96+00.75**, **W(einstein) 5**, and **C0228+612**.

NGC 457, "The Owl Cluster" or "The E.T. Cluster", mag. 6.4, 01 19 32.90 +58 16 41.00, 15'x15' in size, 204 stars, is an open cluster that is detached, strong concentration of stars; large range in brightness; bright cluster; magnitude of brightest star is 7.0. The center star **HD7902** is at magnitude 7.0. **Phi Cassiopeiae**, a red supergiant star, is on the southeast edge of the group, but not part of it. The planetary nebula **WeBo1** is in the cluster. Located 4° southeast of **Gamma Cassiopeiae**. Also known as "**The Dragonfly Cluster**", "**The Phi Cassiopeiae Cluster**", **Cr 12**, **Lund 43**, **Mel 7**, **OCl 321**, **OCl 321.0**, **H7-42**, **Raab 3**, **C(aldwell)13**, and **C0115+580**.

IC 1848, "The Soul Nebula", mag. 6.5, 02 51 25.20 +60 25 08.00, 24'x24' in size, 174 stars, is a faint and very large nebula; irregular in shape; a filamentary structure; nebulosity is brightest in its northeast portion. Contains an open cluster of stars; not well detached from the surrounding star field; large range in brightness; magnitude of brightest star is 7.1. **HD 17505** (**BD+59 522**) at magnitude 7.1 is on the west end of the nebula, and **Cr 34** is on the east end. Also known as **Cr 32=Cr 33**, **Lund 95**, **OCl 364**, **OCl 364.0**, **CTB 11**, **Sh2-199**, **OCl 368.0**, **C0255+602**, (**Cr 33**), **Lund 96**, **Mrk 8**, **Cr 34**, **C0247+602**, **LBN 667**, and **LBN 137.24+00.77**.

NGC 129, mag. 6.5, 00 25 42 +60 12 47, 20.3'x20.3' in size, 193 stars, contains **DL Cassiopeiae**, is an open cluster; not well detached from the surrounding star field; moderate range in brightness; very large cluster; magnitude of brightest star is 8.6. The center star is **DL Cassiopeiae** (**HD 236426**). Also known as **H8-79**, **OCl 294**, **Cr 2**, **Lund 15**, and **C0027+599**.

NGC 654, mag. 6.5, 01 44 01.90 +61 52 59.0, 6.4'x6.4' in size, 83 stars, is an open cluster that is detached, weak concentration of stars; large range in brightness; magnitude of brightest star is 7.4. In the **Cassiopeia OB8 Association**. **IC 166** is 1° to the east. Also known as **H7-46**, **OCl 330**, **OCl 330.0**, **Cr 18**, **Mel 9**, **Lund 53**, **Raab 5**, and **C0140+616**.

NGC 1027, mag. 6.7, 02 42 42.5 +61 36 58.0, 26.4'x26.4' in size, 152 stars, is an open cluster; detached, no concentration of stars; moderate range in brightness; magnitude of brightest star is 9.3. The central star is **HD 16626** (**FO Cassiopeiae**). The cluster has a heavy ring-shaped nucleus. Also known as **H8-66**, **OCl 357**, **Cr 30**, **Mel 16**, **Lund 92**, **Raab 12**, **IC 1824**, and **C0238+613**.

NGC 7789, "Caroline's Rose", mag. 6.7, 23 57 20.2 +56 43 34.0, 30' in size, over 585 stars, is an open cluster; detached, weak concentration of stars; small range in brightness; magnitude of brightest star is 10.7. Discovered by Caroline Herschel in 1783, the loops of stars in it resemble the pattern of rose petals. Located between **Rho** and **Sigma Cassiopeiae**. Also known as "**Caroline's Haystack**", "**White Rose**", "**Magnificent Cluster**", **H6-30**, **OCl 269**, **OCl 269.0**, **Cr 460**, **Mel 245**, **Raab 152**, and **C2354+564**.

NGC 225, "The Sailboat Cluster", mag. 7.0, 00 43 13.2 +61 46 26.0, 25.9'x25.9' in size, is an open cluster; detached, no concentration of stars; small range in brightness; large cluster; involved in nebulosity; "W" shaped. Also known as **H8-78**, **OCl 305**, **Cr 7**, **Lund 25**, and **C0040+615**.

Skiff J0058.4+6828, mag. 7.0, 00 58 24.0 +68 28 00.0, 7' in size, 200 stars. Included is the star **TYC 4296 1455 1** (mag. 10.16) = **GSC 04296-01455** on the west side. Also known as **IRAS 009551+6812**.

St(ock) 5, mag. 7.0, 02 04 24 +64 23 00, 24' in size, 25 stars. The brightest star is **53 Cassiopeiae** (4.9 magnitude) on the west side. Also known as **Lund 70**, **OCl 339**, **OCl 339.0**, and **C0200+642**.

Tr(umpler) 3, mag. 7.0, 03 12 01 +63 13 05, 33.1' in size, 30 stars, is an open cluster; detached, no concentration of stars; large range in brightness. Also known as **Cr 36**, **Harvard 1**, **Lund 101**, **OCl 366**, and **C0307+630**.

Mrk 6, mag. 7.1, 02 29 40 +60 242 24, 6' in size, 29 stars, is an open cluster; detached, no concentration of stars; large brightness range. Also known as **Abt 1**, **Bi(ca) 4**, **Lund 79**, **OCl 351**, **St 7**, and **C0225+604**.

NGC 663, "Letter 'S' Cluster", mag. 7.1, 01 46 20.6 +61 12 43, 18'x18' in size, 108 stars, is an open cluster; appears to contain a group of stars arranged in a 'S' shape; detached, no concentration of stars; large, bright; moderate range in brightness; magnitude of brightest star is 8.4. The stars **Σ 151**, **152**, and **153** are included in this cluster. It has 34 confirmed Be type stars in it. It is in the **Cassiopeia OB8 Association**. Located 1.75° east and 0.5° north of **M103**. Also known as **H6-31**, **OCl 333**, **OCl 333.0**, **C(aldwell) 10**, **Cr 20**, **Mel(otte)** 11, **Lund 55**, **Raab 7**, and **C0142+610**.

IC 1590, mag. 7.4, 00 52 49.2 +56 37 44.0, 6.6'x6.6' in size, 60 stars, is a system with 4 stars in a trapezium shape. Central star is **HD 5005**. Involved with **NGC 281**. Has a lot of Bok/dark globules and a lot of pre-main sequence stars. Also known as **Cr 8**, **OCl 313**, **OCl 313.0**, **Lund 34**, **Mrk 4**, **NGC 281**, **Sh2-184**, **CTB 7**, and **C0049+563**.

NGC 281, "The Pac Man Nebula", mag. 7.4, 00 52 25.1 +56 33 54, 23'x37' in size (a H II region), it includes the β 1 sextuplet star system. It is a pretty faint emission nebula containing a large amount of ionized atomic hydrogen (H II). Located 1.5° east of **Alpha Cassiopeiae**. Also known as **IC 11**, **IC 1590**, **Ced(erblad) 3**, **CTB 7**, **OCl 313**, **OCl 313.0**, **Sh2-184**, **LBN 616**, **LBN 123.17-0628**, **NGC 281 West**, **IRAS 00494+5617**, and **C0049+563**.

LeDrew 1, mag. 7.8, 00 53 18 +19 32, 40' in size, 22 stars. Could be associated with **NGC 752** in **Andromeda**. Also known as **Alessi 1**.

NGC 659, mag. 7.9, 01 44 25.9 +60 40 44, 7.7'x7.7' in size, 30 stars, is an open cluster in the **Cassiopeia OB8 Association**; detached, no concentration of stars; small range in brightness; magnitude of brightest star is 10.4. Also known as **H8-65**, **Cr 19**, **Mel 10**, **OCl 332**, **OCl 332.0**, **Lund 54**, **Raab 6**, and **C0140+604**.

Tr 1, mag. 8.1, 01 35 40 +61 16 59, 3.7'x3.7' in size, 112 stars, is an open cluster; detached, strong concentration of stars; large brightness range; magnitude of brightest star is 9.6. The cluster is called **BD+60 276**. Also known as **Cr 15**, **Lund 48**, **OCl 328**, **Mrk 3**, and **C0132+610**.

NGC 637, mag. 8.2, 01 43 06 +64 02 00, 3.6'x3.6' in size, 20 stars, is an open cluster; detached, strong concentration of stars; large range in brightness; pretty small, bright cluster; magnitude of brightest star is 10.0. Also known as **H7-49**, **OCl 329**, **Cr 17**, and **C0139+637**.

vdB 1, mag. 8.25, 00 10 46.36 +58 46 10.26, 0.001'x0.00' in size, is a double star. Also known as **ADS 129 A** and **B**, **BD+57 18** (magnitude 8.9), **BD+57 19** (magnitude 8.9, and **BD+57 22** (magnitude 8.6), **GSC 03664-01149**, **HD 627**, **HIP 876**, **SAO 021171**, **WDS J00108+5846 Ca** and **Cb**, and **IRAS 00081+5829**.

IC 59 and IC 63, "The Cassiopeia Nebula", "The Gamma Cassiopeiae Nebula", mag. 8.5, fan shaped. **IC 59** – 00 57 12.4 +61 04 59.8, 10' in size, is located 30' north of **Gamma Cassiopeiae**. Also known as **Ced 4A**, **LBN 620**, **Sh2-185**, and **LBN 123.63-01.77**. **IC 63** – 00 59 01.37 +60 17.8, 10' in size, is located 20' north of **Gamma Cassiopeiae**. Also known as **Ced 4B**, **LBN 622**, **Sh2-185**, and **LBN 123.88-01.93**.

King 14, mag. 8.5, 00 31 56.4 +63 09 47, 7'x7' in size, 186 stars, is an open cluster; detached, no concentration of stars; small brightness range; magnitude of brightest star is 11.3. Also known as **Lund 19**, **Alter 1**, **OCl 297**, and **C0029+628**.

NGC 7790, mag. 8.5, 23 58 27.1 +61 12 36.0, 7.1'x7.1' in size, 134 stars, is an open cluster; detached, no concentration of stars; moderate brightness range; magnitude of brightest star is 10.9. Contains the star **CE Cassiopeiae**. Also known as **H7-56**, **OCl 276**, **OCl 276.0**, **Cr 461**, and **C2355+609**.

vdB 8, mag. 8.5, 02 51 32.9 +67 48 49, 1.5'x0.58' in size. Also known as **LEDA 10826**, **MCG+11-04-002**, **IRAS 02471+6736**, and **HD 17443**.

NGC 189, mag. 8.8, 00 39 32 +61 05 24, 9.5'x9.5' in size, 90 stars. Also known as **OCl 301**, **Cr 462**, **Lund 23**, and **C0036+608**.

NGC 436, mag. 8.8, 01 16 00 +58 49 12, 5.4'x5.4' in size, 40 stars. Also known as **H7-45**, **OCl 320**, **Cr 11**, **Mel 16**, **Lund 42**, **Raab 12**, and **C0112+585**.

St 24, mag. 8.8, 00 39 46.8 +61 58 01, 6.4'x6.4' in size, 180 stars. Also known as **Be(rkley) 3**, **Lund 22**, **OCl 302**, and **C0036+616**.

Ha(vard) 21, mag. 9.0, 23 54 17.6 +61 45 43, 4' in size, 26 stars. Also known as **Cr 458**, **Do(lidze) 21**

(incorrectly listed), and **C2351+614**.
King 12, mag. 9.0, 23 53 +61 57, 3’ in size, 35 stars. Also known as **C2350+616**.
NGC 433, mag. 9.0, 01 15 11.5 +60 07 59, 7’x7’ in size, 15 stars. Also known as **OCl 319**, **OCl 319.0**, **Lund 39**, and **C0112+598**.
NGC 103, mag. 9.1, 00 25 14.9 +61 34, 6.4’x6.4’ in size, 38 stars, is in the **Cassiopeia OB4 Association**. Also known as **Cr 1**, **OCl 291**, **OCl 291.0**, **Lund 13**, and **C0022+610**.
NGC 146, mag. 9.1, 00 33 02.9 +63 18 58, 9’x9’ in size, 132 stars. Also known as **Cr 5**, **OCl 299**, **Lund 21**, and **C0030+630**.
Frolov 1, mag. 9.2, 23 57 26.5 +61 37 23, 5’x5’ in size, 25 stars. The central and brightest star is **LS1+61 110** at magnitude 10.7. Also known as **C2354+613**.
NGC 185, mag. 9.2, 00 38 57.9 +48 20 15.03, 11.9’x10.1 in size, is a pretty bright, very large, and round galaxy; a dwarf elliptical of low surface brightness; very faint nucleus. It has an active galactic nucleus (AGN) and is a satellite of the **Andromeda Galaxy** (**M31**). It is paired with the dwarf elliptical galaxy **NGC 147**, the western of the pair. Located about 1° to the west-northwest of **NGC 185**. Also known as **UGC 396**, **H2-707**, **MCG+08-02-010**, **C 18**, **IRAS 00362+4803**, and **LEDA 2329**.
OCl 275, OCl 275.0, Cr 459, and C2354+611.
NGC 381, mag. 9.3, 01 08 19.9 +61 35 02, 11.2’x11.2’ in size, 50 stars, is an open cluster that is a member of the **Cassiopeia OB1 Association**. Also known as **H8-64**, **OCl 317**, **OCl 317.0**, **Cr 10**, **Lund 38**, and **C0105+613**.
Cr 3, mag. 9.4, 00 31 16.9 +63 21 10, 7’ in size, 20 stars. Located in **NGC 133**.
NGC 133, mag. 9.4, 00 31 12.0 +63 23 49, 13’ in size, 40 stars. Also known as **Cr3, OCl 296,** and **C0028+630.**
NGC 7788, mag. 9.4, 23 56 43 +61 23 42, 5.4’x5.4’ in size, 20 stars, is an open cluster that is part of the **Cassiopeia OB5 Association**. Also known as **OCl 275**, **OCl 275.0**, **Cr 459**, and **C2354+611**.
NGC 147, mag. 9.5, 00 33 12.12 +48 30 31.46, 13.2’x7.7’ in size, is a very faint, very large dwarf elliptical galaxy; irregularly round; bright, extremely small nucleus. It is a satellite of the **Andromeda Galaxy** (**M31**). It is paired with **NGC 185** and is the eastern of the pair (located 1° to the east-southeast of **NGC 147**). Also known as **C 17**, **UGC 326**, **DDO 3**, **LEDA 2004**, and **MCG+08-02-005**.
NGC 559, mag. 9.5, 01 29 32.9 +63 18 04, 9.7’x9.7’ in size, 50 stars, is an open cluster; detached, weak concentration of stars; moderate range in brightness; magnitude of brightest star is 10.6. Also known as **C 8**, **H7-48**, **OCl 322**, **Cr 13**, **Lund 45**, **IRAS 01259+6301**, and **C0126+630**.
NGC 743, mag. 9.5, 01 58 27.4 +60 07 48, 14.8’x14.8’ in size, 17 stars. Also known as **OCl 343** and **Lund 66**.
King 21, mag. 9.6, 23 49 55.0 +62 42 18, 5.5’x5.5’ in size, 20 stars. Also known as **Lund 1048**, **OCl 220**, and **C2347+624**.
Be 58, mag. 9.7, 00 00 15.1 +60 56 31, 7.2’x7.2’ in size, 39 stars. Also known as **OCl 277.0** and **C2357+606**.
NGC 110, mag. 9.7, 00 27 25.2 +71 25 19, 19’ in size, 100 stars. Also known as **OCl 300**, **h22**, **GSC 4303-01643** (9.71 magnitude), and **C0024+711**.
NGC 278, mag. 9.71, 00 52 04.34 +47 33 01.67, 1.57’x1.53’ in size. Located 2.3° east-southeast of NGC 185. The 9th magnitude star HD 4950 is 2.6’ to the north. Also known as **LEDA 3051**, **UGC 528**, **IRAS 00492+4716**, **MCG+08-02-016**, **H1-159**, **PGC 003051**, **CGCG 550-016**, and **C0049+4717**.
Cz 3, mag. 9.9, 01 03 07 +62 47 12, 3’ in size, 10 stars. Also known as **Lund 36**, **OCL 315**, and **C0100+625**.
IC 1871, mag. 10.0, 03 03 00 +60 24. Also known as **LBN 675**, **LBN 138.50+01.59**, and **Ced 20**.

Objects of interest beyond magnitude 10:

NGC 609, mag. 11.0, 01 36 24.5 +64 32 24, 3.1’x3.1’ in size, 80 stars. Also known as **Cr 16, King 3**, **OCl 325**, **Lund 50**, and **C0133+643**.
NGC 7635, “The Bubble Nebula”, mag. 11.0, 23 20 48.3 +61 12 06, 205”x180” in size, is a H II region with an emission shell. Within the shell is **BD+60 2522** (magnitude 8.7), an “O” type giant emission line star. Located 6.4° northeast of **Beta Cassiopeia**, or 36.2’ southwest of **M52**. There is a 7th

magnitude star (**HD 220057**) 6' to the west-southwest. **SAO 20606** (**BD+60 2532**, magnitude 8.3) is on the southwest fringe. To the north is **Sh2-167**. Also known as **LBN 549**, **LBN 548**, **H4-52**, **Sh2-162**, and **C 11**.

Cassiopeia Dwarf = Andromeda VII, mag. 11.8, 03 27 48 +50 35, is a dwarf galaxy. Also known as **LEDA 2807155**, and **Cas dSph (Cassiopeia Dwarf Spherical)**.

Semeis 22, "The Shrimp Nebula", and "The Dolphin Nebula", mag. 12.1, 01 30 33 +58 24 51, 9'x8' in size, 60-70 stars, centered on the star **HD 5005** (magnitude 8.5), is a crescent-shaped nebula. Also known as **Sh2-188**, **LBN 633**, **PNG 128.0-04.1, PK 128-04.1,** and **LBN 128.04-04.12.**

Cassiopeia A, "SN 1671", 14th magnitude, 23 23 24 +58 48 54, 5'x5' in size, was a supernova – the brightest astronomical/radio source in the sky and one of the first discovered (in 1947) -in 1671. It has high velocity ejecta knots (1,825 knots) travelling at 5500 to 14,500 km/second. Also known as **3C461**, **4C 58.40**, **CTB 110**, **1ES2321+5833**, **NRAO 711**, **SNR G111.7-02.1**, **SN 1667**, and **SN 1680**.

Sh2-157, "The Lobster Claw Nebula", 23 16 07.3 +60 02 31, 3.32'x1.68' in size, 50 stars, includes **Sh2-157a**. Also known as **Sh1-109**, **LBN 557**, **LBN 111.14-00.22**, **UGCA 37**, and **Mel 157**.

St 23, "Pazmino's Cluster", 03 16 18.0 +60 22 37, 9.05'x9.05' in size, 25 stars. The center and brightest star is **HD20040** (magnitude 7.6); detached, no concentration of stars; large brightness range; involved in nebulosity. Also known as **Lund 104**, **OCl 375**, **OCl 375.0**, and **C0312+598**.

Deep Sky objects in Cassiopeia: 2 Messier; 40 NGC; 16 IC; 29 UGC; 2 UGCA; 36 PNG; 32 PK; 8 Abell PN; 24 MCG; 21 Ced(erblad); 76 C(Aldwell); 11 King; 123 LDN; 32 LBN; 15 St(ock); 10 Mel(lotte), 19 Herschel; 9 Raab; 2 h; 19 Be(rkley); 32 C(ollinde)r; 3 vdB; 28 Sh2; 1 Sh1; 14 C(e)z(nik); 12 Radio galaxies; 1 Quasar; 3 Teutsch; 9 FSR; 3 Do(lize); 2 Tr(umpler); 2 SNR; 6 SAI; 3 Pot; 5 Pat; 2 MC; 1 SG; 1 SL; 2 RNO; 4 H II Regions; 1 ERS; 1 QSO; 3 Molecular Clouds; 1 Cas dSph; 5 K3; 1 K4; 1 PB; 1 Kr; 3 PGC; 1 Pal; 5 Wein(stein); 1 Hu; 1 WeSb; 1 HeDe; 1 Tom; 2 Ha(vard); 1 Outters; 1 Semeis; 3 ES; 2 Str; 7 CTB; 1 MWC; 6 W(esterhaut); 1 Kro; 2 Al; 1 1ES; 2 Skiff; 1 LeWa; 1 JuSa; 1 [PTB93]; 1 LeDrew; 2 PWM; 1 DG; 1 B; 5 HBC; 1 Mayer; 1 Frolov; 2 Maffei; 1 Hrr; 1 VY1; 1 CHR; 1 EGB; 2 HDW; 1 Dias; 1 Dawes; 1 HFG; 3 MB; 1 Ray; 1 Al-Teu; 1 Frr; 1 GM1; 2 Pfl; 2 SK; 2 Dwingeloo; 4 ASCC; 4 Alessi; 2 HaWe. 4 H(ubble); 2 HH; 1 WeBo; 1 BV3; 2 BV5; 99 C(luster); 47 CGCG; 110 OCl; 45 LEDA; 1 SFG 1; 1 KjPn; 1 Min; 6 OHIO; 4 QSO; 3 DSH; 2 FGC; 1 KPG; 1 Sharpless; 1 1E; 1 PKS; 10 GSC; 2DDO; 2 EQ; 6 NPM1G; 11 NRAO; 1 2C; 12 3C; 13 4C; 1 7C; 10 8C; 74 Lund; 38 IRAS; 3 VV; 4 VV'; 1 5Zw; 1 7Zw; 1 Gamma Cas Nebula; 1 Cassiopeia A; and 1 Cas Dwarf galaxy for a total of 1248 objects.

Other Stars:

48 Cassiopeiae (A Cas), mag. 4.49, 02 01 57.55 +70 54 25.4, is a quadruple star. Also known as **HD 12111** and **HIP 9480**.

Rho Cassiopeiae, mag. 4.51, 23 54 23.04 +57 29 57.8, is a yellow hyper-giant eruptive semi-regular pulsating variable star. Its magnitude varies from 4.5 to 6.2 in a period of about 320 days. There are only seven known yellow hyper-giant stars in the **Milky Way Galaxy**. It is in the **Cassiopeia OB5 Association**. Also known as **HD 224014**, **HIP 117863**, and **7 Cassiopeiae**.

AR Cassiopeiae, mag. 4.89, 23 30 01.92 +58 32 56.1, is a sextuple star and an Algol variable star. Also known as **HD 221253** and **HIP 115990**.

V509 Cassiopeiae, mag. 5.10, 23 00 05.10 +56 56 43.4, is a yellow-white hyper-giant semi-regular variable star whose magnitude varies from 4.75 to 5.5. Also known as **HD 217476** and **HIP 113561**.

HR 8832 (HD 219134), mag. 5.57, 23 13 14.7 +57 10 03.5, is a suspected variable star with seven planets in orbit. Also known as **HIP 114622**.

HD 2952, mag. 5.93, 00 33 10.32 +54 53 42.3, has one planet in orbit. Also known as **HIP 2611**.

HD 220074, mag. 6.39, 23 20 14.37 +61 58 12.5, has one planet in orbit. Also known as **HIP 115218**.

HD 11755, mag. 6.87, 01 58 50.0 +73 09 09, has one planet in orbit. Also known as **HIP 9242**.

HD 17505, mag. 7.08, 02 51 07.98 +60 25 03.9, is a star associated with a bow shock. Also known as

HIP 13296.
HD 7924, mag. 7.19, 01 21 59.12 +76 42 37.0, has three planets in orbit – orbital periods: b – 5.4 days; c – 15.3 days; and d – 24.4 days. This is a main sequence dwarf star located 5.4° east of **Gamm**a **Cassiopeiae**. Also known as **HIP 6379** and **SAO 4386**.
HD 108, mag. 7.40. 00 06 03.39 +63 40 46.8, is a binary runaway star with a variable spectrum. Also known as **HIP 505**.
HD 221585, mag. 7.47, 23 32 54.0 +63 09 20, has one planet in orbit. Also known as **HIP116221**.
HD 13908, mag. 7.51, 02 18 15.0 +65 35 40, has two planets in orbit, one at a separation of 0.154 au with a 19-day orbit, and the second at a separation of 2.03 au with a 931-day orbit. Also known as **HIP 10743**.
HD 15558, mag. 7.78, 02 32 42.54 +61 27 21.6, is an extremely luminous binary star located in IC 1805. Also known as **HIP11832**.
HD 220842, mag. 7.99, 23 26 37.0 +56 53 12, has one planet in orbit. Also known as **HIP115714**.
HD 240237, mag. 8.17, 23 15 42.22 +58 02 35.7, has one planet in orbit at a separation of 1.9 au and having an orbital period of 745 days. Also known as **HIP 114840**.
HD 17520, mag. 8.24, 02 51 14.46 +60 23 09.6, transitioned to a Be type star in the 1980's. Also known as **HIP 13308**.
HD 240210, mag. 8.33, 23 10 29.23 +57 01 46.0, has one planet in orbit at a separation of 1.16 au and has an orbital period of 501 days. Also known as **SAO 35195**.
HD 217850, mag. 8.5, 23 02 37.0 +58 52 34, has one planet in orbit. Also known as **HIP 113789**.
BD+60 2522, mag. 8.7, 23 20 44.52 +61 11 40.6, is the source of **NGC 7635** – the **Bubble Nebula**.
HD 219415, mag. 9.84, 23 14 54.0 +56 43 49, has one planet in orbit.

Stars of interest beyond magnitude 10:

WR 3, mag. 10.69, 01 38 55.63 +58 09 22.7, is a star surrounded by a unique stellar-wind bubble. Also known as **HD 9974** and **HIP 7681**.
LS1 +61 303, mag. 10.8, 02 40 31.67 +61 13 45.6, is a micro-quasar. Also known as **HIP 12469** and **V523 Cassiopeiae**.
WASP-93, mag. 10.97, 00 37 50.0 +51 17 20, has one transiting planet.
2S 0114+650, mag. 11.09, 01 18 02.70 +65 17 29.9, is an X-ray pulsar star. Also known as **HIP 6081** and V662 Cassiopeiae.
WR2, mag. 11.33, 01 05 23.01 +60 25 19.0, is a WN2 type star and the only one known, also a **GRB** candidate. Also known as **HD 6327**.
RX J0146.9+6121, mag. 11.34, 01 47 00.21 +61 31 23.7, is an X-ray pulsar star in **NGC 663**. Also known as **V831 Cassiopeiae**.
HAT-P-44, ma 13.21, 00 56 50.3 +47 00 52, has two transiting planets in orbit.
V664 Cassiopeiae, mag. 14.56, 03 08 42.01 +64 54 35.7, is the center star of **HFG 1**, a re-radiating binary system.
4U 0115+634, mag. 15.19, 01 18 31.90 +63 44 24.0, is an X-ray pulsar star. Also known as **V635 Cassiopeiae**.
4U 0142+61, mag. 25.62, 01 46 22.21 +61 45 03.8, is a magnetar star.
IGR J00291+5934, is an X-ray pulsar – a millisecond pulsar. Also known as **V1037 Cassiopeiae**.
1E 2259+586, 23 01 18.14 +58 52 44.5, is a magnetar star.
PSR B2319+60, 23 21 55.21 +60 24 30.7, is a pulsar star.
PSR B2334+61, 23 37 05.78 +61 51 01.7, is a pulsar star.
PSR J0205+6449, 02 05 37.92 +64 49 42.0, is the central pulsar of **3C 58** – a super nova remnant and pulsar wind from **SN 1181** – a possible quark. Located 2° northeast of **Epsilon Cassiopeiae**.
W3 IRS 5, 02 25 40.54 +62 05 51.4, is a proto-star; possibly similar to a proto-trapezium.
IRAS 00338+6312, 00 36 47.5 +63 29 07, is a proto-star.

Asterisms in Cassiopeia:

The Queen's "W", mag. 2.0, 01 00 +60 00, 13'x5' in size, is a false "**Pleiades**" of 6th magnitude stars located 1.5° north of **NGC 188**. Consists of **Alpha**, **Beta**, **Gamma**, **Delta**, and **Epsilon**

Cassiopeiae.

"**Airplane**", mag. 5.0, 23 20 +62 20, 60' in size, is 8 7th and 8th magnitude stars 40' northwest of **M52**. Also called "**The Arrow**".

Lucky "7", mag. 5.0, 23 03 +59 30, 125'x70' in size, includes **1** and **2 Cassiopeiae**.

Queen's "Kite", mag. 5.0, 01 38 +58 30 2'x1.5' in size, is a rough pentagram of stars including **Chi Cassiopeiae**.

Kemble's Kite, mag. 6.0, 03 28 +72 00, 90'x30' in size, located 2° west of **Gamma Cassiopeiae**. Includes the star **SAO 4917**.

Eddie's Coaster, mag. 7.0, 01 02 +63 36, 2'x1.5' in size, is a curved chain of 7th and 8th magnitude stars.

Foo-Loo, from the Chinese for "bypath", consists of **Zeta** and **Lambda Cassiopeiae**.

Ko Sing, from the Chinese for "**Guest Star**", consisting of **Tycho's Star** and **Tycho's Nova** (**SN 1572**).

Yűh Lang or **Wang Leang**, consists of **Alpha**, **Beta**, **Eta**, and **Kappa Cassiopeiae**.

Stars in Cassiopeia:

26 Greek; 45 Σ; 21 OΣ; 4 OΣΣ; 56 Numbered; 90 Lettered; 29 β; 3 HV; 8 A; 1 Bvd; 1 Mlr; 1 CHR; 1 Eng; 1 Kr; 1 Dawes; 5 Hu; 1 Frk; 1 Arg; 7 h; 11 Es; 1 S; 1 E; 157 V(ariable); 1 Stn; 2 HBC; 1 M1b; and 1 St for a total of 478 stars.

Sky Happenings: July, 2023

(what follows pertains ONLY to the current month. Material above is good year after year.)

July 1st - **Mercury** is in superior conjunction at 12 AM CDT,
Antares is 1.5° south of the **Moon** at 3 AM CDT,
Dusk: In the west **Venus** and **Mars** are about 3.5° apart.

July 3rd - **Full Moon** occurs at 6:39 AQM CDT.

July 4th - The **Moon** is at perigee (223,786 miles or 360,149 km from **Earth**) at 5:25 PM CDT.

July 6th - The **Earth** is at aphelion (94.5 million miles or 152,093,251 km from the **Sun**) at 3 PM CDT,
Evening: The waning gibbous **Moon** rises in the east-southeast in tandem with Saturn at about 3° of separation,
The **Moon** passes 3° south of **Saturn** at 10 PM CDT.

July 7th - **Venus** is at greatest brilliancy at magnitude -4.7 at 9 AM CDT,
Asteroid **Eunomia** is at opposition at 3 PM CDT.

July 8th - The **Moon** passes 1.7° south of **Neptune** at 9 AM CDT.

July 9th - Dusk: **Mars** and **Regulus** shine above the western horizon with less than 1° separation with **Venus** about 4.5° to the lower right of the pair,
Last Quarter Moon occurs at 7:48 PM CDT.

July 10th - **Mars** passes 0.7° north of **Regulus** at 3 AM CDT.

July 11th - The **Moon** passes 2° north of **Jupiter** at 4 PM CDT.

July 12th - The **Moon** passes 2° north of **Uranus** at 1 PM CDT.

July 13th - The **Moon** is 1.7° south of the **Pleiades** (**M45**) at 1 AM CDT.

July 14th - **Mercury** is 0.2° north of the **Beehive Cluster** (**M44**) at 9 PM CDT.

July 17th - **New Moon** (lunation 1244) occurs at 1:32 PM CDT.

July 19th - The **Moon** passes 4° north of **Mercury** at 4 AM CDT,
Dusk: The extremely thin lunar sliver, **Mars**, **Venus**, and **Mercury** form a rhomboid low on the western horizon after sunset.

July 20th - The **Moon** is at apogee (252,456 miles or 406,289 km from **Earth**) at 1:57 AM CDT,
The **Moon** passes 8° north of **Venus** at 4 AM CDT,
Venus is stationary at 6 PM CDT,
Dusk: The waxing crescent **Moon**, **Venus**, and **Mars** form a triangle near **Regulus** in the west

after sunset,
The **Moon** passes 3° north of **Mars** at 11 PM CDT

July 21st - **Pluto** is at opposition at 11 PM CDT.

July 24th - Evening: In the west-southwest the nearly first quarter **Moon** and **Spica** sink toward the horizon with 2° separation.

July 25th - **First Quarter Moon** occurs at 5:07 PM CDT.

July 26th - **Mercury** passes 5° north of **Venus** at 8 AM CDT.

July 28th - Antares is 1.3° south of the Moon at 1 PM CDT,
Mercury passes 0.1° south of Regulus at 8 PM CDT.

July 29th - The **Southern Delta Aquariid** meteor shower peaks at 12 noon CDT.

July 30th - The **Moon** will set in the wee hours of the morning after which viewing of the **Southern Delta Aquariid** meteor shower improves.

Planets:

Mercury- **Mercury**, on July 1st at midnight (12 AM CDT) is in superior conjunction. The planet will gradually return to the evening sky where it will be at the Beehive Cluster (M44) on July 15th. On the 20th, the planet, at magnitude -0.4, will stand 11.4° northwest of Venus about 1 hour after sunset. After making quick progress east, the planet will be 5.5° due north of Venus on the 25th. On the 28th, the planet now at magnitude 0.0 will stand less than 10' from Regulus – catch it as soon as possible as soon as the sky darkens because both will set an hour after sunset – they will be only 6° above the horizon.

Venus – Venus (at magnitude -4.7) and Mars (at magnitude 1.7) are separated by 3.5° on July 1st. On the 7th, the planet will reach its greatest illuminated extent when it is 26% illuminated crescent shines at magnitude -4.7. The planet will set 2 hours after the Sun. Throughout the month the planet will have an apparent size growing from 34" to 54". On the 9th, the planet is 4.7° west of Mars and Regulus. The planet will continue its eastward movement but never makes it to Regulus as it begins to dip lower in the western sky. By the 20th, the crescent Moon will be 4.5° east of Regulus while the planet lies 3.9° southwest of Regulus and will then begin its retrograde motion.

Mars – Mars, at magnitude 1.7 and a disk of 4" in Leo, will be 3.6° east of Venus on July 1st. On the 9th the planet is about 0.75° from Regulus. On the 19th, the planet is less than 6° to the above left of Regulus. On the 20th, the Moon will make a quartet with Mars, Regulus, and Venus.

Jupiter – Jupiter is in Aries, at magnitude -2.3. On July 1st, the planet rises at 1 AM CDT and just after local midnight on the 31st, when it reaches magnitude -2.4. The planet will be 35° high in the east as dawn begins. The planet will have moved 4° east during the month, ending the month at 2.5° southeast of Hamal (Alpha Arietis).

Saturn – Saturn will rise at around 10:30 PM in Aquarius on July 1st, and a couple of hours earlier at the end of the month. The planet starts the month at magnitude 0.7, brightening by 0.2 magnitudes during the month. Telescope views will reveal its 18" wide disk with the ring system at an 8.1° tilt from our line-of-sight. The planet's brightest moon Titan, at magnitude 8.5, will stand north of the planet on the 6/7th and 22/23rd nights, and south of the planet on the 14/15th and 30/31st nights. The moon Iapetus will reach superior conjunction on the 13th and will pass 36" south of the planet. On the 14th, Iapetus will stand less than 30" due west of Titan.

Uranus – Uranus is in Aries about 11° east of Jupiter and 9° southwest of the Pleiades (M45) in the predawn sky. By 4 AM it is low in the east just as Taurus has cleared the horizon, shining at magnitude 5.8 and due south of a small semicircular arc of 4th and 5th magnitude stars. On the 12th, the planet will stand less than 4° due west of the Moon in the growing twilight with Jupiter, M45, the Hyades, and Aldebaran joining in.

Neptune – Neptune rises shortly after midnight in early July and is well placed for viewing before dawn. The planet reaches a stationary point on July 1st and will then move westward (retrograde0 only 0.3° all month. The planet is located 4.7° southeast of Lambda Piscium, shining at magnitude 7.7. The planet's path, north of 20 and 24 Piscium, will form a triangle with the stars that will change shape slightly each night – the planet is the northern most object. A telescope will show a tiny, bluish disk 2" wide.

Pluto – Pluto will start the month (July 1st through 9th) in Capricornus about 1.2° due south and a touch east

of M75 along the Capricornus/Sagittarius border. On July 9th through 31st the planet will move to 1.2° south and a touch west of M75.

Moon – The Moon's favorable librations are Volta Crater on July 3rd; Brianchon Crater on July 4th; and Byrd Crater on July 5th.

Greatest North declination on the 16th (+27.9°)
South declination on the 3rd (-27.8°) and on the 30th (-27.7°)
Libration in Longitude: East limb most exposed on the 11th (+6.7°)
West limb most exposed on the 27th (-7.7°)
Libration in Latitude: North limb most exposed on the 5th (+6.5°)
South limb most exposed on the 18th (-6.6°)

Asteroids* / *Minor Planets All positions given are from the ***RASC Observer's Handbook*, *2023 USA Edition***, unless otherwise noted.

Asteroid **1 Ceres** – **Ceres's** positions are as follows: On July 5th – 12 26.14 +06 42.6, at magnitude 8.6 in **Virgo**; on the 15th – 12 36.2 +04 54.7, at magnitude 8.7 in **Virgo**; and on the 25th – 12 47.31 +03 04.4, at magnitude 8.8 in **Virgo**. **Ceres's** positions, ***by my estimates***, are as follows: On July 1st – on the southwest edge of **NGC 4365**; on the 5th – about 1° southeast of **NGC 4365** or about 1.5° south-southwest of **M49**; on the 10th – about 2.4° northeast of **M52** or 1.9° south and a touch west of **NGC 4526**; on the 15th – about 2.2° north-northwest of **NGC 4635** or 3.5° due east and a touch north of **M51**; on the 20th – about 1° due north of **NGC 4365**; on the 25th – 1.2° due east and a touch north of **NGC 4636** or 1.5° west-southwest of **Delta Virginis**; and on the 30th – about 1.5° due south and a touch west of **Delta Virginis**.

Asteroid **8 Flora** – **Flora's** positions are as follows: on July 5th – 22 48.47 -11 38.4, at magnitude 9.7 in **Aquarius**; on the 15th – 22 52.07 -12 07.3, at magnitude 9.5 in **Aquarius**; and on the 25th – 22 52.69 -12 58.4, at magnitude 9.2 in **Aquarius**.

Asteroid **10 Hygiea** - **Hygiea's** position on July 25th is 21 27.35 -11 55,7, at magnitude 9.9 in **Aquarius**.

Asteroid **11 Parthenope** -**Parthenope's** position on July 5th is 16 33.82 -16 43.8, at magnitude 9.5 in **Ophiuchus**.

Asteroid **15 Eunomia** – **Eunomia's** positions are as follows: On July 5th – 19 09.96 -25 16.2, at magnitude 8.8 in **Sagittarius**; on the 15th – 18 59.26 -24 56.0, at magnitude 8.8 in **Sagittarius**; and on the 25th – 18 49.27 -24 18.4, at magnitude 9.0 in **Sagittarius**.

Asteroid **18 Melpomene** – **Melpomene's** position on July 25th is 02 00.99 +06 29.5, at magnitude 9.9 in **Pisces**.

Comets* –** Comet **237 P/Linear** – **237P's** positions, ***by my estimates; are as follows: On July 1st – about 3° due south and a touch east of **Eta Aquilae**; on the 5th – about 2.2° due south and a touch west of **Eta Aquilae**; on the 10th – about 2° west-southwest of **Eta Aquilae**, or 3° northeast of **Iota Aquilae**; on the 20th – about 2.5° north-northeast of **Iota Aquilae**; on the 25th – about 2.2° north and a touch east of **Iota Aquilae**; and on the 30th – about 2.6° north and a bit west of **Iota Aquilae**, or 3.5° east and a bit south of **NGC 6790**, or 3.8° southeast of **Delta Aquilae**.

***Meteor Showers* –** All information is from the **International Meteor Organization**.

There are two **Major** (**Class I**) meteor showers active in July. The **Southern Delta Aquariids**, active from July 18th through August 21st, peaks on July 31st with a mzhr (maximum zenith hourly rate) of 20; The **Perseids**, active from July 14th through September 3rd, peaks on August 13th.

There are two **Minor** (**Class II**) meteor showers active in July. The **July Pegasids**, active from July 4th through August 8th, peaks on July 11th with a mzhr of 5; The **Alpha Capricornids**, active from July 7th through August 15th, peaks on July 31st with a mzhr of 4.

There are no **Variable** (**Class III**) meteor showers active in July.

There are nine **Weak** (**Class IV**) meteor showers active in July – all have a mzhr of<2.

The **Phi Piscids**, active from June 13th through July 5th, peaked on June 25th; the **Microscopiids**, active from June 25th through July 16th, peaks on July 6th; the **July Chi Arietids**, active from June 26th through July 22nd, peaks on July 7th; the **Phi Piscids**, active from July 2nd through July 22nd, peaks on July 10th; the **c-Andromedids**, active from June 21st through July 28th, peaks on July 12th; the **Northern June Aquilids**, active from June 26th through July 22nd, peaks on July 15th; the **Zeta Cassiopeiids**, active from July 2nd through July 22nd, peaks on July 16th; the **July Gamma Draconids**, active from July 23rd through August 3rd, peaks on July 28th; and the **Eta Eridanids**, active from July 10th through September 10th, peaks on August 6th.

Mythology

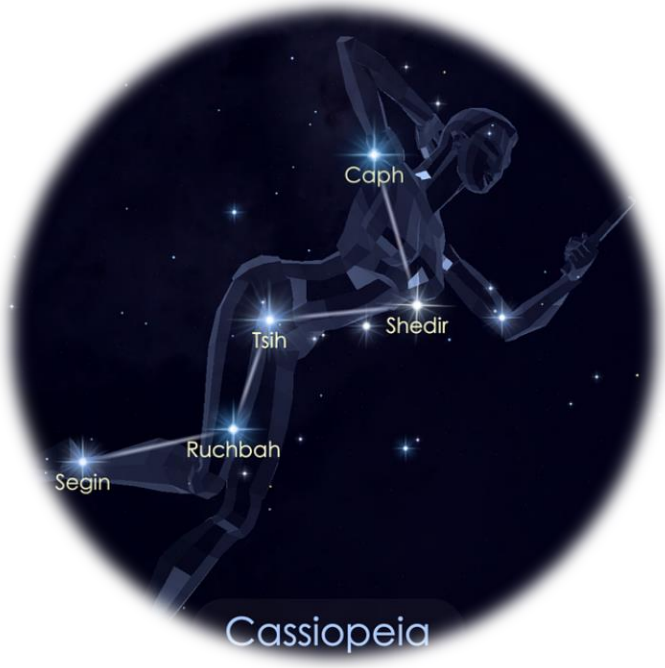
Cassiopeia – The Queen of Ethiopia

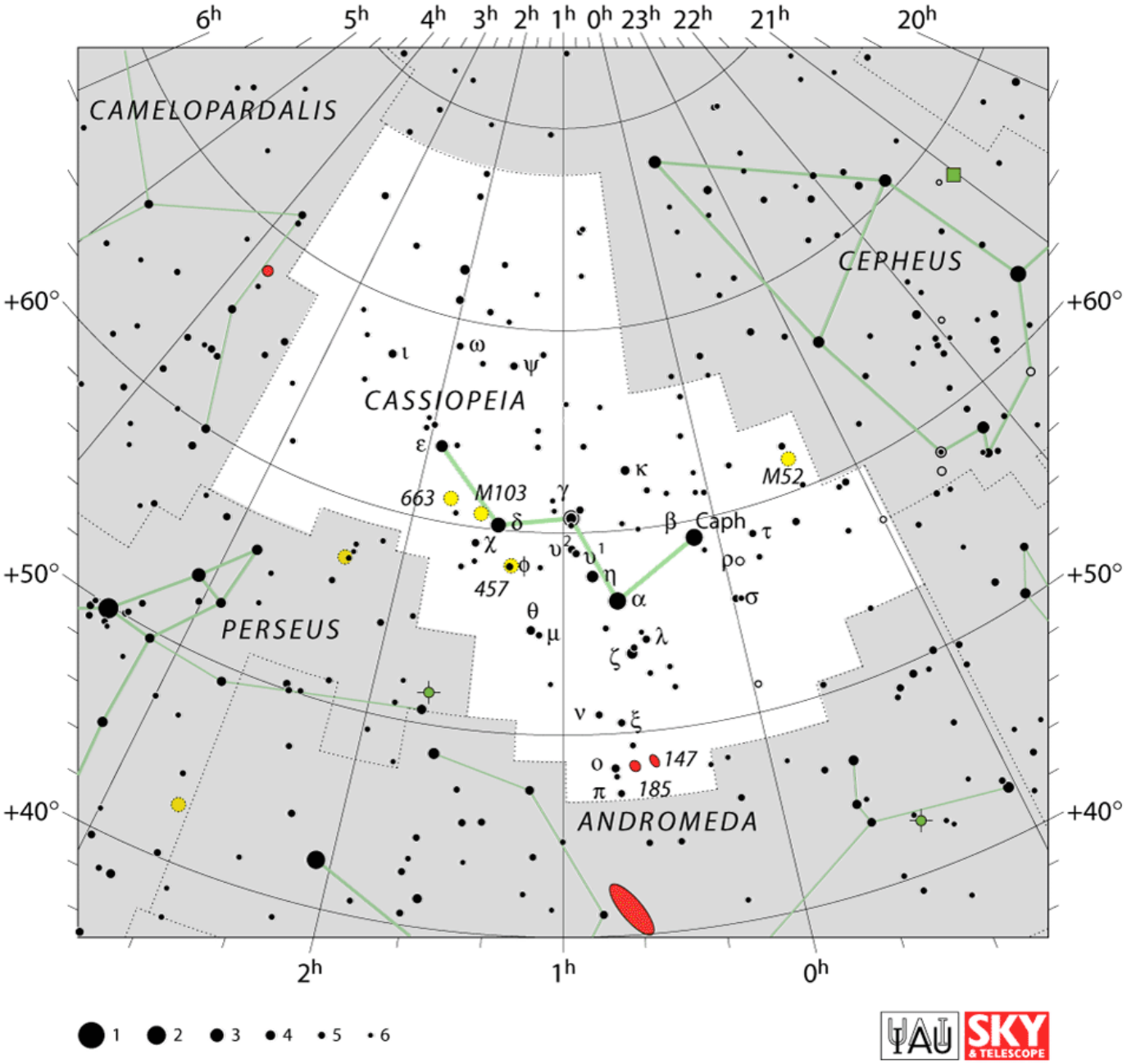
Cassiopeia was the vain and boastful wife of Cepheus of Ethiopia, who lies next to her in the sky. They are the only husband-and-wife couple among the constellations. Classical authors spell her name Cassiopiea, but Cassiopeia is the form used by astronomers.

While combing her long locks one day, Cassiopeia dared to claim that she was more beautiful than the sea nymphs called the Nereids. There were fifty nereids, daughters of Nereus, the so called Old Man of the Sea. One of the Nereids, Amphitrite, was married to Poseidon, the sea god. The Nereids appealed to Poseidon to punish Cassiopeia for her vanity, and the sea god sent a monster to ravage the coast of King Cepheus's country. This monster is commemorated in the constellation Cetus. To appease the monster, Cepheus and Cassiopeia chained their daughter Andromeda to a rock as a sacrifice, but Andromeda was saved from the monster's jaws by the hero Perseus in one of the most famous rescue stories in history.

As an additional punishment, Cassiopeia was condemned to circle the celestial pole for ever, sometimes hanging upside down in an undignified posture. In the sky Cassiopeia is depicted sitting on her throne, still fussing with her hair.

The constellation of Cassiopeia has a distinctive "W"-shape made up of its five brightest stars, which writers such as Aratus likened to a key or a folding door. Alpha Casiopeiae is called Sheder, from the Arabic meaning "the breast", which position it marks. Beta Cassiopeiae is known as Caph, from the Arabic, meaning "the stained hand", as it was thought by them to represent a hand stained with henna. Delta Cassiopeiae is named Ruchbah, from the Arabic, meaning "knee". The central star of the "W", Gamma Cassiopeiae, is an erratic variable star given to occasional outbursts in brightness.

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The End