# Nightfall

A Publication of the Huachuca Astronomy Club

March 2021


## President's Notes

Time to go Paleolithic?

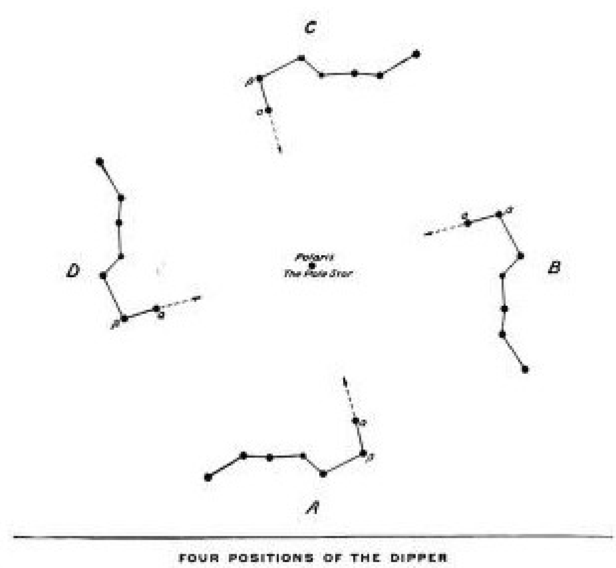
It's March 2021 HACers. The skies are clean and dark so let's look at something.

As we began last month talking about the book, A Beginner's Star-Book, I intend to cover the sky from a beginner's point of view, mostly. My intention with this series isn't to cover all the stars and objects each month but rather to add a bit here and there, to sometimes go a little deeper into a constellation or object, or class of object, or enforce a concept brought up by the book. However, if something comes along like a bright comet, a big sunspot group or an impending asteroid crash I may vary away from our plotted course. Oh, and from now on I'll refer to it as the star-book.

You always have free choice on where to begin when slogging across the sky, or as many say: star-hopping. But it is a good idea to orient yourself in some way before you begin. You can use your smart phone app or a GPS device of course, or go old school and use a compass, or Paleolithic (maybe earlier) and just look up and find the north star.

The night charts and key map section of the star-book starts by having us look to the north, so let's do that. But before we go to page 44, where we will be looking for Polaris, the north star, let's go to page 22, Chapter 3, "Learning to Observe: Four Key Groups." Polaris isn't the brightest star up there, nor is it colorful, or even in a bright constellation. So, to find it reliably we need to find something that is big, is bright, and nearly universally recognizable (not universal at all, but a lot of people on Earth's northern hemisphere continents know it). I'm talking about the Big Dipper, also known Ursa Major (the Big Bear), or the Plough or the wain (or wagon, four wheels, no oxen, I think), or even the big shopping cart. See how constellations can bring people together?

Polaris and the Hub of Earth's Rotation




Source: A Beginner's Star-Book; An Easy Guide to the Stars and to the Astronomical Uses of the Opera-Glass, the Field-Glass and the Telescope (the star-book), Kelvin McKready, 1912-1929, p 23.

In March, as you face north, you should see Ursa Major at about position B.

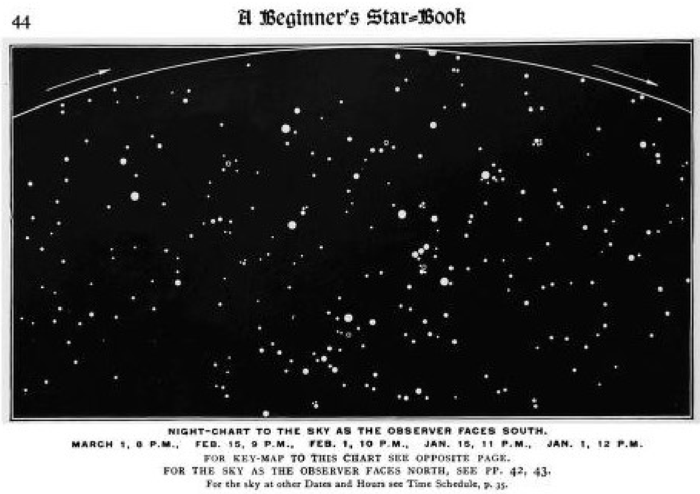
. Continuing, in chapter 3, you will be introduced to three more star-groups (constellations for the most part) that help define the seasons when they are up in the southern sky. Orion (the hunter) is a constellation composed of big bright stars (many are known to be giants and super giants), and centerpiece of the winter-spring sky (we will be visiting him this month and next). Corvus (the crow), is a diamond- or a kite-shaped (no, not box kite) constellation that is easily recognizable by five bright stars seen spring to summer. Hopefully, by the time we get to summer-fall we will be ready for the more complex and dimmer constellation of Capricornus (the horned goat). We will need to star hop to nail that one down.

Now that we know how to find the north and south, the four cardinal directions can be found reliably. We are now ready to use the star-book. The star-book really starts on page 37, chapter 4, "The Night-Charts and Key-Maps for Any Year," with sets of four charts and maps covering the months of

January to the previous November (but that's long past so we will move along to the next set), starting on page 44.

The way the star-book covers the night sky is cool. It gives a black and white chart that represents the sky as seen with the unaided eye from a relatively dark site. Not as dark as our Sierra Vista skies out of town, but good for the bright stars, or as if you just came outside from the bright indoors. Across the gutter (the fold between pages), on the right-hand page is a key-map that names the constellations, very bright stars, and some of the noted objects, such as those from the Messier catalog. The ensuing pages repeat the format when looking south and the set of four pages are repeated in sets covering the sky in two-month intervals.

A Night Chart



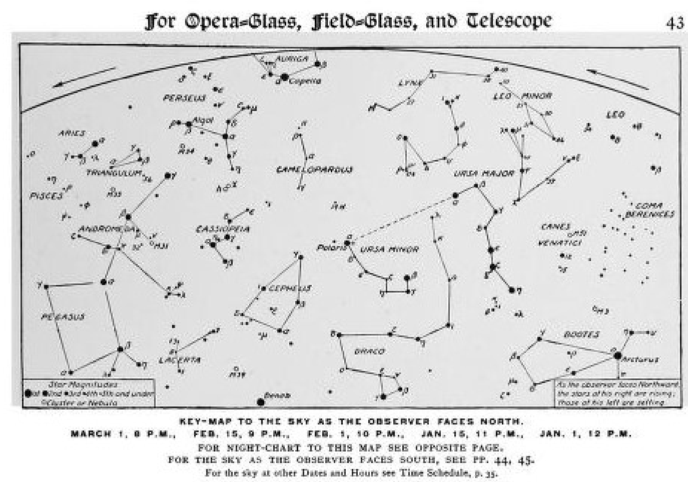

Source: The star-book; McKready, p 44.

Write ups below the charts and maps give directions and descriptions to objects in the night sky covered by those charts and maps. Now, often I discount the value of defined constellations, but here with their correct usage I pay homage. As much as I dislike their usage as mystical power infused objects (as when they are used to divine one's personality or future fate), when used suitably to discern specific physical patterns, constellations are a powerful learning tool. These write-ups are what, I think, make this book special. The left pages are devoted to the constellations from the perspective of an observer, unaided by binocular or telescope. Just look up, see the stars, and connect the dots. Flesh those lines out, give them the appearance of a memorable person, animal, keepsake, or mythical beastie and you have constellations. Give those constellations back-stories and you have fodder for many nights around the glowing embers of the dimming campfire.

Somewhere between just looking up and long-gone campfire tales the ancients conferred the collected wisdom of thousands of earth adventurers into the night sky. Stories of long-gone kingdoms and powerful heroes. Comedies and tragedies were replayed and refined. Time and seasons were discovered and determined. Reliable harbingers of the future, signaling when the rains would always make the rivers ebb and flow, when fruits would set and ripen and grasses would grow tall again, and even when wild game would return. Those directions were drawn in the in the dirt, then wet clay, and then set-in stone for all to use. The movement of the sun across the daytime sky was delineated to measure the passage of time during the day and the beasties' march across the sky over the course of the night confirmed time was continuous, relentless, grinding to all mortals. But if mere men could but look up in the ink-filled night, they could glimpse the eternal, the unchanging heavens. Powerful stuff. The driving needs to understand the mechanics and meaning of these objects and their movements has fueled all the feats of civilization. Faith, art, engineering, and science. But I'm off topic again.

Anyway, to star hoppers, and that's what we want to become, the Big Dipper is considered the gateway to the north and the arrow to Polaris. At this time of year March, the dipper is handle down, bowl up and to the east of the north pole as shown in the key map below.

A Key Map: For March 1, Looking North

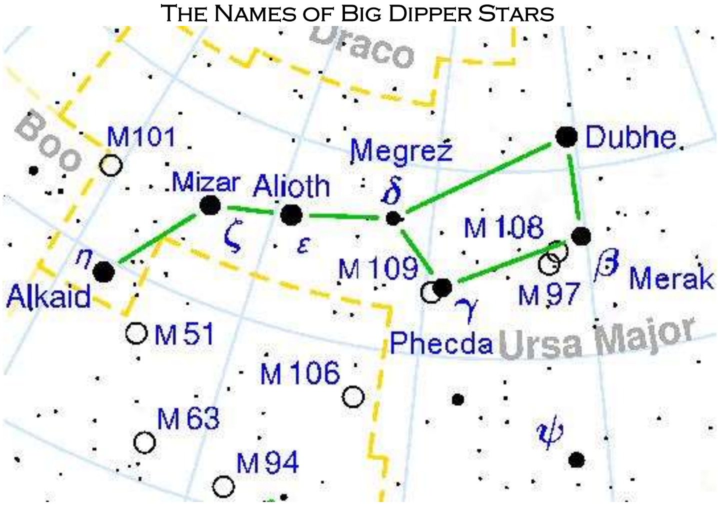



Source: The star-book, McKready, p 43.

For those of you who really want the whole sky experience, each of the main stars of the Big Dipper have proper names. Dubhe and Merak are the two stars that point north to Polaris. Mizar is a visual double (that is, you can discern it as two stars using little or no magnification). Its companion is named Alcor. Alcor itself is a telescopic double, and each of the component stars of Alcor and Mizar are themselves doubles. On the chart below you will also see that there are eight M-objects circled. Those designate Messier catalog objects.

These are various galaxies and nebulae that will be bright enough for all but the smallest telescopes. You'll find M101 to be a beautiful face-on spiral galaxy known as the pinwheel, and M51, perhaps *the* showcase spiral galaxy, that is interacting with another galaxy. Also at the bottom of the dipper's bowl is M 97 (owl nebula), a planetary nebula. Even in a small telescope its ghostly shape is quite apparent. And yes, you can detect it in binoculars with steady hands in a very dark sky, but I don't think you will appreciate it. Run a web search for Messier Catalog and the object's number to get all the information you'll need to bag these not-so-faint fuzzies. NASA has a nice site devoted to the catalog: https://www.nasa.gov/content/goddard/hubble-s-messier-catalog. [Oh, just as a suggestion, type in "Messier" along with the catalog number, not just M and you won't be sidetracked into weeding through military equipment that also commonly carry a M plus number designation.]

The Names of Big Dipper Stars

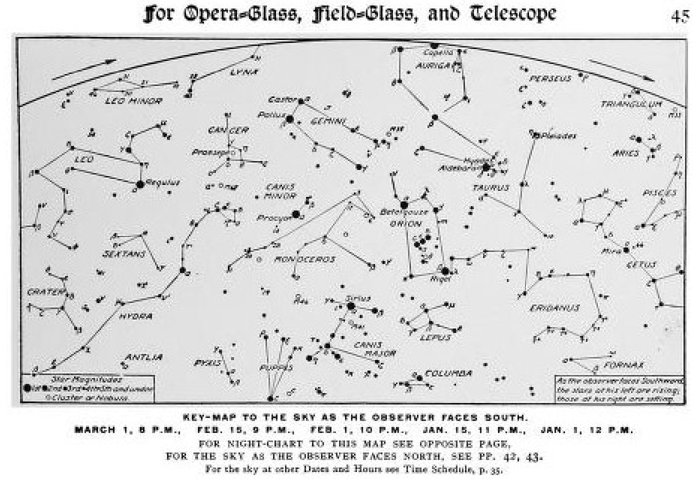



Source: https://en.wikipedia.org/wiki/Big_Dipper

Outreach has reminded me that many of us just starting out make mistakes when it comes to Polaris and the Big Dipper. Many expect Polaris to be bright, a beacon to the north. Some think it is the tail of the Big Dipper (it is actually the tail of the Little Dipper), and some of us even confuse the Big Dipper with the small bright Pleiades star cluster in the constellation of Taurus, well to the south. Most of these misconceptions are just from getting the disassociated information in books and not having the sky put in context, personally. So many of us on this planet live in areas where nighttime sky brightness bleaches out stars as dim as Polaris. The dark skies around us here in Cochise county are to be celebrated and cherished; anytime it's clear the north star is there for our viewing. So, get a lot of practice finding it and notice the changes in the position of the Big Dipper.

By the way, the star-book discusses "physical star clusters" and the Pleiades in particular on pages 17-19. Also, the Pleiades are marked on the south-facing key map on page 45 (again, it is in the constellation of Taurus). Additionally, the grouping (or asterism) is known as M45, the 45th entry in the catalog of celestial objects collected by Charles Messier (by the way, that is pronounced MEH-see-yay, and is not some commentary on Charles' tidiness).

A Key Map: For March 1, Looking South (The Pleiades star cluster is circled)




Source: The star-book; McKready, p 45.

Messier's entire catalog (or most of it) can be viewed in one night, at the right time of the year, with the proper low eastern and western horizons. This usually occurs during the new moon nights of March or April. Known as a Messier Marathon, it is a dash to catch sight of a few objects beginning in the early dusk, then a more constant slog through the night before another sprint of finding the last few objects just before sunrise. It can be a fun time. The club usually has a star-party/marathon scheduled, but in this year of uncertainty we haven't. If we keep up this examination of the star-book, however, we should be ready for next year, and hopefully by then we can safely schedule it as a club outing.

Start getting experience using the star-book. Read the early chapters. Reach out to newer references when your interest is sparked. Work on the March key maps when clear skies permit and as always, get out there and stare.

## The astronomer

### By Dwight Hoxie

I began as an amateur astronomer in high school in Minnesota; built, with a friend, a 6-inch pipe-fittings Newtonian reflector; marveled at the Heavens and went on to become a "professional" astronomer. It happened like this . . .

From high school I went to the University of Chicago to major in physics. While there I went to work for Tanaka Namioka who was co-inventor of the Seya-Namioka vacuum ultraviolet (UV) monochrometer. Upon receiving his PhD in physics, he accepted employment at Kitt Peak National Observatory (KPNO) and I followed him as his assistant where we set up a Seya-Namioka monochrometer to explore the realm of the deep UV. Upon commencing operation of the instrument Dr. Namioka ran into visa problems and had to resign his position at KPNO who then knew not what to do with me and the monochromometer. I forged ahead and obtained some very beautiful results for the Lyman series of hydrogen (Lyman alpha has a wavelength of 121.6 nm) but as I had no PhD at the time the project was shut down, the instrument sold and I was dispatched to pass a delightful summer working atop Kitt Peak (before today's paved highway to the summit was constructed) setting up equipment and participating in a survey crew conducting repeated surveys to make sure that telescope locations on the mountain were as accurate as possible.

In the fall I entered the graduate astronomy program at the University of Arizona (Note: KPNO is just across the street from the U of A's Steward Observatory) and went to work for Aden Meinel then at the U of A's Lunar and Planetary Laboratory (LPL). This time I set up a Perkin-Elmer infrared (IR) spectrometer (of Meinel's design) and proceeded to obtain lovely spectra of what might have been lightning in Venus's $CO_2$ atmosphere. Well, Meinel went off to other pursuits and I received a fellowship to work under Ray Weyman to receive my PhD in astronomy/astrophysics. My dissertation topic was "The structure and evolution of stars of very low mass". The major outcome of my work was to show that the minimum mass of a stable star that could meet its energy requirements by internally transforming hydrogen into helium was about 0.07 times the mass of the Sun or about ten times the mass of Jupiter.

My student days at Steward Observatory were days spent surrounded by notable personages. Gerard Peter Kuiper (of the "Kuiper Belt") was director of the LPL and Bart J. Bok ("Bok globules") was director of Steward Observatory. The two Dutchmen were not close friends. My advisor Ray Weyman was one of the discoverers of large-scale gravitational lensing. Of my fellow graduate students Fred Chaffee went on to became director of the Harvard-Smithsonian"s Observatory on Mt. Hopkins and then was director of the two giant Keck telescopes atop Hawaii's Mauna Kea. Bill Hartmann became a leader amongst the planetary scientists and led the move to demote Pluto from "planet" to "dwarf planet". Tom Arny went on to professorship at the University of Massachusetts and is author of the undergraduate astronomy textbook "Explorations".

Today Steward Observatory and affiliate astronomical programs at the U of A have produced one of the world's largest astronomical institutions with more than 1,000 employees. The astronomy department itself consists of 85 faculty members – about ten times as many as there were in my student days.

I received my PhD in 1969, accepted a two-year postdoctoral fellowship at the State University of New York at Stony Brook, Long Island. At that time the astronomers at Stony Brook cohabited with the geologists in the then Department of Earth and Space Sciences. It is more customary for astronomers to join forces with physicists to form Departments of Physics and Astronomy but at Stony Brook at that time, the physicists regarded astronomers with disdain. Today SUNY at Stony Brook, however, proudly advertises its "Department of Physics and Astronomy".

But I enjoyed my tenure in the company of the geologists because I was a mineral collector in my own right and very interested in all things geologic. Stony Brook University was young at the time and only had a small population of students; there were a few geology students but no astronomy students. The course catalog offered a course in Solar System Astronomy and a group of geology students wanted to take it. This was at the time of Apollo 11, and the Moon and planets were generating considerable excitement. But there was no one on the existing faculty to teach such a course so I volunteered even though I did not hold a faculty position. The highlight was that my wife, our VW bus, a van and my nine students, cameras and telescopes all headed south to camp overnight at the north end of the Chesapeake Bay Bridge–Tunnel in Virginia to enjoy an excellent view of the 07 March 1970 total eclipse of the Sun.

My fellowship at Stony Brook ended and I found employment on the faculty in the Department of Physics and Astronomy at the University of Nebraska-Lincoln (UNL) where I taught both astronomy and physics courses. My wife and I departed Long Island in June giving us a free summer that we spent in an unoccupied cabin on the North Rim of the Grand Canyon. We were there assisting our friend Peter Huntoon, then a graduate student in geohydrology at the University of Arizona, field check his mapping of the geology of a part of the Grand Canyon. We made several ventures from the North Rim into rarely traveled parts of the Canyon mostly checking the locations of faults and other geologic features that Peter had located from satellite photos.

In the Fall, we reported to Lincoln, Nebraska, just in time for the year that the Nebraska Cornhuskers and the Oklahoma Sooners (with their fancy-dancy Wishbone-T offense) both were going undefeated until their Thanksgiving Day "game-of-the-century" shoot-out in Norman, Oklahoma. Nebraska prevailed by winning 35-31 only because they happened to be ahead when time on the clock ran out. I learned of the passion with which Nebraskans regard their Cornhuskers. On home-game Saturdays Lincoln, Nebraska, decorated home and business alike and time stopped until that day's game was over.

Was it coincidence or providence? Our friend Peter Huntoon arrived at UNL with his PhD and a joint position in the UNL Geology Department and in what effectively was Nebraska's state geological survey. He arrived armed with the then U.S. Geological Survey's (USGS's) groundwater-flow modelling computer program. Nebraska grows corn and grows it by drilling wells to extract groundwater to water the growing corn. (Nebraska has two natural resources –

groundwater and football players!) As thousands of wells were punched into the ground to extract groundwater to water growing corn groundwater supplies were being diminished. Some kind of regulation needed to be imposed and groundwater-flow models could be employed to guide rational regulation of groundwater use.

I had considerable experience in modeling stars, that is, in modeling fluid flow under gravity which is what Peter's computer program did and I began helping my friend Peter to adapt and extend his program for application in Nebraska. We achieved such success that I was offered a job (at better pay than I was receiving as an astronomer) with the Nebraska geological survey which I accepted. I was dispatched off to southwestern Nebraska to implement our modelling expertise in what are called the "sandhills" where corn was being grown virtually hydroponically. Corn is planted in porous sand, water is pumped from deep within an aquifer, nutrients are added to the water and a center pivot irrigation system applies the water to nourish the corn.

I no more than embarked on this project when the USGS offered me a job (at yet higher pay) in Wyoming (where I was raised as a child) that I couldn't refuse. So astronomy settled into the background except for one night when camped out under the stars at 9,000 feet in Wyoming's Bighorn Mountains. I layed back in my sleeping bag and looked up to marvel at the heavens above and - something was awry! There was a second magnitude apparent star in Cygnus that didn't belong in Cygnus! It kept its position in Cygnus throughout the night. A return to civilization revealed it to be Nova 1975d (V 1500 Cygni). The Heavens were yet capable of provoking shock and awe in an expat astronomer!

I began by looking at the Heavens from outside in and ended up by looking at the Heavens from the inside out. It is these points of view that distinguish the "amateur" from the "professional" astronomer. Using the "forest" and the "trees" as analogy, the amateur astronomer looks at the forest from outside and marvels at all of the different kinds of trees and their individual beauties. The professional astronomer, however, gains license (PhD) to enter the forest and focusses attention on the inner workings of particular species or types of trees and often times loses the sense of marvel and awe with which he/she might have begun. Maybe, just maybe it's all those hoops through which one must jump – calculus, differential equations, classical mechanics, quantum mechanics, stellar interiors, stellar atmospheres and so on – that leaves the professional astronomer a bit jaded by the time he/she reaches the final hurdle of defending their dissertation before the academic panel that will admit them into the fraternity of "professional" astronomers. The big change for me on the day of my thesis defense was from that day onward I could address my thesis advisor as "Ray" instead of "Dr. Weymann". Awesome, no?



This article is distributed by NASA Night Sky Network

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## Taking the Dog Stars for a Springtime Walk: Sirius and Procyon

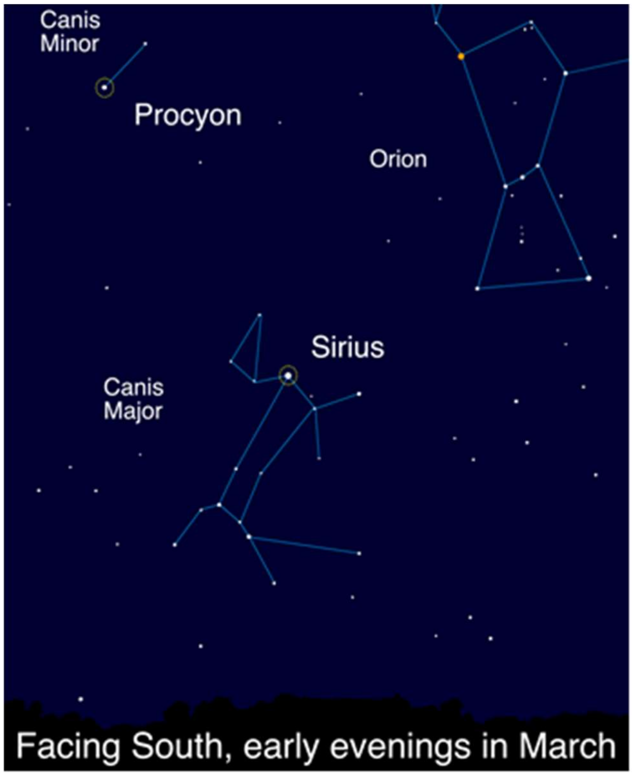
### David Prosper

March skies feature many dazzling stars and constellations, glimmering high in the night, but two of the brightest stars are the focus of our attention this month: Sirius and Procyon, the dog stars!

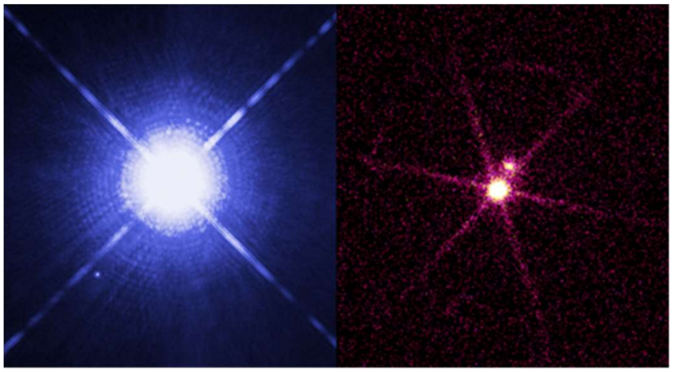
Sirius is the brightest star in the nighttime sky, in large part because it is one of the closest stars to our solar system at 8.6 light years away. Compared to our Sun, Sirius possesses twice the mass and is much younger. Sirius is estimated to be several hundred million years old, just a fraction of the Sun's 4.6 billion years. Near Sirius - around the width of a hand with fingers splayed out, held away at arm's length - you'll find Procyon, the 8th brightest star in the night sky. Procyon is another one of our Sun's closest neighbors, though a little farther away than Sirius, 11.5 light years away. While less massive than Sirius, it is much older and unusually luminous for a star of its type, leading astronomers to suspect that it may "soon" – at some point millions of years from now – swell into a giant star as it nears the end of its stellar life.

Sirius and Procyon are nicknamed the "Dog Stars," an apt name as they are the brightest stars in their respective constellations – Canis Major and Canis Minor – whose names translate to "Big Dog" and "Little Dog." Not everyone sees them as canine companions. As two of the brightest stars in the sky, they feature prominently in the sky stories of cultures around the world. Sirius also captures the imaginations of people today: when rising or setting near the horizon, its brilliance mixes with our atmosphere's turbulence, causing the star's light to shimmer with wildly flickering color. This vivid, eerie sight was an indication to ancient peoples of changes in the seasons, and even triggers UFO reports in the modern era!

Both of these bright stars have unseen companions: tiny, dense white dwarf stars, the remnants of supermassive companion stars. Interestingly, both of these dim companions were inferred from careful studies of their parent stars' movements in the 1800s, before they were ever directly observed! They are a challenging observation, even with a large telescope, since their parent stars are so very bright that their light overwhelms the much dimmer light of their tiny companions. The white dwarf stars, just like their parent stars, have differences: Sirius B is younger, brighter, and more energetic than Procyon B. Careful observations of these nearby systems over hundreds of years have helped advance the fields of: astrometry, the precise measurement of stars; stellar evolution; and astroseismology, the study of the internal structure of stars via their oscillations. Discover more about our stellar neighborhood at nasa.gov!




Sirius and Procyon, the loyal hunting dogs of nearby Orion the Hunter! What other stories can you imagine for these stars? Learn about "Legends in the Sky" and create your own with this activity: https://bit.ly/legendsinthesky Image created with assistance from Stellarium.

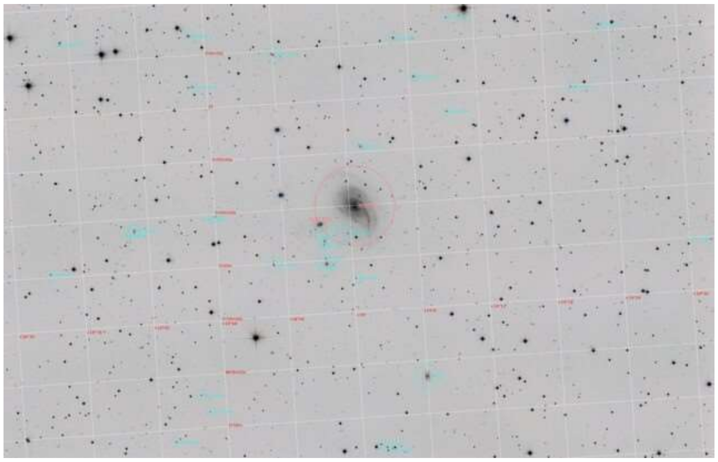


Sirius A and B imaged by two different space telescopes, revealing dramatically different views! Hubble's image (left) shows Sirius A shining brightly in visible light, with diminutive Sirius B a tiny dot. However, in Chandra's image (right) tiny Sirius B is dramatically brighter in X-rays! The "Universe in a Different Light" activity highlights more surprising views of some familiar objects: http://bit.ly/different-light-nsn NASA, ESA, H. Bond (STScI), and M. Barstow (University of Leicester) (left); NASA/SAO/CXC (right)

## Pictures from HAC Members

NGC 772 by Glen Sanner

NGC 772 by Glen Sanner Annotated



Barnard 207, LBN 777 & LBN 775 By Glen Sanner

The Crab Nebula (Messier 1) by Matt Lieber

Minkowski 1-7 By David R

Minkowski 2-9 By David R

Jonckheere 900 Extreme crop By David R

## FOR SALE

Patricia Houser has two telescopes to sell. Her husband was the astronomer, and can no longer pursue the hobby. She did not mention what the scopes are but would be open to potential buyers coming out to see them (Whetstone). That's all the information we have, so if you have questions please contact Ms. Houser directly at iamtennis@peoplepc.com

## Club Officers and Contacts

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# HAC Mar/Apr Calendar of Events

| SU | MO | TU | WE | TH | FR | SA |
|---|---|---|---|---|---|---|
| 28 | 1Mar | 2 | 3 | 4<br>Jup/Mercury Conjunction Vesta Opposition | 5<br>6:32 PM | 6 |
| 7 | 8 | 9 | 10 | 11 | 12 | 13<br>3:23 AM |
| 14<br>Daylight Savings Time Begins | 15 | 16 | 17<br> | 18<br>Patterson Public Night (tentative) | 19 | 20<br>Vernal Equinox 1:37 AM |
| 21<br>7:41 AM | 22 | 23 | 24 | 25 | 26<br>HAC Meeting (Zoom) | 27 |
| 28<br>11:48am | 29 | 30 | 31 | Apr 1 | 2 | 3 |
| 4<br>3:04am<br>EASTER | 5 | 6<br>Saturn/moon 4° | 7<br>Jupiter/moon 5° | 8 | 9 | 10 |
| 11<br>7:32pm | 12 | 13 | 14 | 15 | 16 | 17<br>Mars/Moon .1° |
| 18 | 19 | 20<br>midnight | 21<br>Lyrid Meteors | 22<br>Patterson Public Night<br>Lyrid Meteors | 23<br>HAC Meeting (Zoom) | 24 |
| 25 | 26<br>8:33pm | 27 | 28 | 29 | 30 | |

All times local MST

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Watch the group for notice when in person events and meetings will resume