Nature Under the Stars
Streaming on Facebook
May 29 @ 8:30

Download accompanying materials beginning May 25 at wildernesscenter.org
Welcome to Nature Under the Stars

This packet contains the following supplemental materials for our Nature Under the Stars program.

- Your Eyes at Night
- Backyard Firefly Data Sheet
- Firefly Coloring Page
- Planisphere
- Under the Dome – learn the constellations
- Night Sky Scavenger Hunt

When doing the outside activities, it is best to put your phone or tablet on night mode, or use a red flashlight to read printed activities. The red light will allow your eyes to adapt to the night sky more quickly.

The book for Story Time is called *Cassandra and The Night Sky*, written by Amy Jackson, Illustrated by Donna Paredes

Have a wonderful night!
Your Eyes at Night

Look at the diagram below. The back of your eye is covered with photo-receptors (they receive light signals) called rods and cones. Rods are used in low light levels and cones detect color. In your eyes, the cones are found in the very back, while rods are spread out around the edges.

This arrangement of rods and cones dictates how we see at night. For instance, when you look at the stars, it is easier to see them if you look slightly to the left or right; that way, the rods in your peripheral vision detect the light. Because your cones do not function well in low light, you cannot see color at night. Don’t believe that? Take the color test.

Take the Color Test!

Your eyes cannot see colors at night. Take the test to prove it to yourself!

1) Gather up your old crayons - ones without paper are best
2) Go out on a dark night.
3) Pick a crayon.
4) In the space below, write the word of the color you think you have. (If you think it is red, write “red”)
5) Pick another crayon and try again.
6) Come back inside and see if the color matches the color you wrote.

The color of my crayon is:

The Wilderness Center
BACKYARD FIREFLY SHOW!

Chart the activity of fireflies in your backyard. You will end up with a graph displaying your data!

<table>
<thead>
<tr>
<th>A LOT!</th>
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<tbody>
<tr>
<td>10 or more</td>
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<tr>
<td>Many</td>
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<tr>
<td>6-10</td>
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<tr>
<td>A few</td>
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<td>1-5</td>
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<tr>
<td>None</td>
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First, write the date of your observation, starting with the far left date box. Then, count the number of fireflies in your backyard. (You may need to give it some time!) If you do not see any, color in the box above the date. If you see some, color in the box that matches the number you have counted. The next time you observe, fill in the date box to the right of the last observation and color in the box for the number of fireflies you count. When you are finished, do you see a pattern or trend? Over the time period, do the numbers go up, stay the same or go down?

Want to help fireflies with Citizen Science? Check out: https://www.massaudubon.org/get-involved/citizen-science/firefly-watch

Download this activity sheet at www.wildernesscenter.org
Instructions for using Uncle Al's Star Wheels:

1. Align your date and time, and then look up at the sky.
2. Locate the constellation you want to find on the map.
3. Turn your map so the horizon is closest to the bottom.
4. The star positions in the sky should match those on the wheel.

Download Uncle Al's Sky Wheels from https://dsluser.nmsu.edu/uncleal ngânal/uncleal_interaktiv.php

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Available through LHG Museum Store
INSTRUCTIONS FOR ASSEMBLING UNCLE AL’S STAR WHEELS

Step 1: Print out all pages either on heavy cardstock or paste them onto a file folder or any other sturdy piece of cardboard.
Step 2: Cut along the black outer circle of the Star Wheel and along the solid lines on the Star Wheel Holder. Remove the interior oval shape on the Star Wheel Holder.
Step 3: On the Star Wheel Holder, fold the cardboard along the dashed lines.
Step 4: Tape or staple along the edges of the Star Wheel Holder forming a pocket.
Step 5: Place the Star Wheel in the Star Wheel Holder.

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Uncle Al’s HOU Star Wheels are based on LHS Sky Challengers created by Budd Wentz and available through the LHS Discovery Corner Store 510-642-1016
http://lhs.berkeley.edu/pass/AST110&111&121.html
Download Uncle Al’s Sky Wheels from http://lhs.berkeley.edu/starclock/skywheel.html

Version: May 2009
Under the Dome
Big Dipper and Ursa Major

The pattern of the Big Dipper is one of the most recognizable in the night sky. It looks like a big soup ladle. Look toward the Northeast. At the beginning of May the Dipper is standing on its handle. By the end of the month the Dipper is high overhead and the bowl is upside down in the sky. The Big Dipper has seven stars, three in the handle and four in the bowl. There is an American Indian story that sees these stars as an animal they call Fisher. Fisher is a large fox-like animal. There was a time when people and animals were brothers and sisters. They talked with each other all the time about the sky country. Once there was a winter that did not end, spring came, and it was still snowy and cold. Fisher told the people that summer would not come until the birds of summer returned, but they were being held captive by an evil chieftain. The people and animals made a plan to free the birds. One night they went to the land of the evil chieftain and released all the birds of summer. The evil chieftain heard them, everyone escaped except for Fisher. Fisher ran up a tall tree with the chieftain right behind him. When Fisher got to the top of the tree, he jumped into the sky country. We can see him there still with his tail pointing back down to Earth.

Did you notice that I didn’t call the Big Dipper a constellation? That’s because it is not a constellation. There are 88 official constellations in the night sky and the Big Dipper isn’t one of them. We call patterns like the Big Dipper asterisms. Asterisms are patterns that are not one of the 88 official constellations - but recognizable patterns coming from a more modern cultural reference. In other cultures, these seven stars have been seen as a plough, a wagon, a jaguar and a bear.

The Big Dipper is part of the constellation called Ursa Major, one of the official 88 constellations and the third largest constellation in the night sky. Ursa Major is Latin for the “Greater Bear.” Many cultures on Earth have associated these stars with the figure of a bear. In nearly every Native American tribe bears figure prominently in their mythology. In most of these cultures the bear is considered to be a medicine being with very impressive magical powers. Bears are symbols of strength and wisdom and are often associated with healing and medicine as it is believed they can heal their own wounds.
Under the Dome
Little Dipper and Ursa Minor

To find the Little Dipper we use the Big Dipper. Draw a line using the two stars at the front of the Big Dipper bowl. These stars are called the pointer stars. Extend the line straight out and it runs into Polaris. Polaris is our North Pole star and the last star in the handle of the Little Dipper. Just like the Big Dipper the Little Dipper has seven stars, three in the handle and four in the bowl. And like the Big Dipper the Little Dipper is an asterism. The official name of this constellation is Ursa Minor, Latin for the “Lesser Bear” or the “Little Bear.” Folks are sometimes disappointed with the Little Dipper. Except for Polaris and the two stars at the front of the bowl, called the “Guard Stars,” the rest of the stars are not very bright. A clear dark night makes finding this constellation easier, no full moon or light pollution. There is a story telling how in Ursa Major’s old age she grew greedy and wanted Polaris for herself. It is said she wanted Polaris because it was as bright as her own stars. But for all her plotting and planning and attempts to steal Polaris she never succeeded. The “Guard Stars” which are located between Polaris and Ursa Major protect Polaris to this day from the Big Bear.

Probably the most interesting thing about the “Little Bear” is the star Polaris. Polaris is called the “North Star” because it is always in the north, marking the celestial north pole. Many believe that Polaris is the brightest star in the sky. This is not so. Actually, it is no brighter than the stars of the Big Dipper. Polaris is a white supergiant star located 430 light years from Earth. Its radius is 22 million miles which is about 50 times the size of our own sun and is estimated to be 4.5 times more massive than our sun. Due to its size Polaris has a luminosity 2500 times greater than our sun. This is the only reason it appears as bright as it does given its distance from Earth.

If you were to stand at the North Pole of Earth, Polaris would be almost directly overhead. I say “almost directly overhead” because to be precise Polaris is half a degree off the pole. If the Earth’s axis were extended into the sky it would appear to intersect with Polaris. This is why Polaris is the only star in the sky that does not appear to move as the Earth rotates on its axis. Watch how the Dippers and the Bears move through the night. They appear to be circling Polaris.
Under the Dome

Bootes

Bootes (pronounced Boo-OH-teez), the Herdsman, is an ancient constellation. To find Bootes we will use the handle of the Big Dipper, follow the curve or the arc of the handle and we “arc to Arcturus” – the bright star in the constellation. Bootes looks like a crooked kite and is located just above the celestial equator, so it is visible in both northern and southern hemispheres most of the year during some part of the night.

Arcturus is a red giant star. The name Arcturus comes from the Greek words arktos and oursos meaning “Bear Watcher” or “Bear Guardian.” Arcturus is the fourth brightest star in the entire night sky and the brightest star north of the celestial equator. It is about 25 times the diameter of our Sun or about 22 million miles across. Arcturus is estimated to be 6 to 8.5 billion years old and is 37 lightyears from Earth. The light from Arcturus is so bright, between 100 to 200 times brighter than our Sun, that it was used to open the Chicago World’s Fair in 1933. Telescopes were used to focus the star’s light on several photoelectric cells. The current generated by the cells flipped a switch that turned on the floodlights at the exhibition grounds.

It used to be thought the stars were fixed, that they did not move. However, in about 1717 Edmund Halley was comparing the modern position of Arcturus with Greek records of the star’s position and found that the star had moved. In fact, Arcturus is moving at a speed of 76 miles/second through the galaxy, not in the plane of the galaxy but almost perpendicular to the galaxy, like a stone dropped into a pool of water. Arcturus isn’t the only star with this motion and trajectory, there are 52 other stars collectively known as the “Arcturus Stream” that have the same motion and trajectory. It is thought that Arcturus and the other 52 stars may have formed in a dwarf galaxy that collided with and was devoured by the Milky Way long ago. Because of its motion, in about a million years, Arcturus will no longer be visible to Earth.

Arcturus was important to many different cultures. Prehistoric Polynesian navigators called Arcturus Hokule‘a, meaning “Star of Joy.” The Polynesians would sail their double-hulled canoes from Tahiti traveling east and north until they crossed the equator and reached the latitude where Arcturus was directly overhead in the summer night sky. Arcturus is the zenith star for Hawaii. At this position Arcturus marked the exact latitude of the Hawaiian Islands. They would then adjust their direction and sail west to Hawaii.
Under the Dome
Virgo

The constellation of Virgo, a woman holding two sheaves of wheat, is located east of Leo. The way to best find Virgo is to find the constellation’s bright star Spica. To do this use the bright star Arcturus in the constellation Bootes. Find Arcturus and then spike to Spica. Virgo lies directly on the celestial equator making her visible to star gazers in both the northern and southern hemispheres. Virgo is the second largest constellation in the sky; however, except for Spica her stars are dim, and they really don’t seem to look like a person. Once you find Spica look for the lopsided rectangle, which is the torso of Virgo. Spica is the lower southeastern corner of this rectangle.

Spica is a blue giant star, about 20,000 times brighter than our Sun and seven times as big as the Sun. Spica is the 14th brightest star in the sky lying about 250 light years away. Spica comes from Latin and means ear of wheat or ear of grain. Spica lies near the Ecliptic, the apparent path of the Sun, Moon and planets through the sky as seen from Earth. If you see another bright object close to Spica it will be a planet, Jupiter, Saturn or red Mars.

Virgo has been known as the Earth-goddess and associated with the arrival of spring for at least 5,000 years, but she most likely much older than this. People were farming at least 10,000 years and possibly up to 15,000 years ago. Nearly 15,000 years ago the Sun was in the constellation of Virgo at the Spring Equinox. For people living in the northern hemisphere it would be time to plant and for those in the southern hemisphere it would be time to harvest. Both events would have been a time to celebrate and honor the Earth-goddess. The following myth has been found in many cultures, including the Sumerians, Babylonians, Greeks, Romans, Egyptians and Saxons to name a few, each weaving it into their own culture making it their own. In Egypt, the Earth-goddess Virgo was known as Isis, the Goddess of Fertility. Isis lost her husband, Osiris, and had to abandon her Earth duties to find him. When she left Earth to look for Osiris winter gripped the land and the Earth was dark and cold. Not until her return did spring come with it light and warmth and the richness of the Earth. On one of her travels across the heavens looking for Osiris she was carrying a sheaf of wheat. She accidentally shook the sheaf and scattered the wheat grains, spreading the grains around the heavens. We see these grains today as the Milky Way. We usually see Virgo carrying two sheaves of wheat, one which marks the bright star Spica in her left hand and another in her right hand.
Under the Dome

Draco

Draco, the Dragon, is another circumpolar constellation. It's the eighth largest constellation in the sky with a part of its long body and tail snaking around the Little Dipper and between the Big and Little Dippers. Except for the stars forming the eyes, the stars in this constellation are not very bright. The brightest star Eltanin, the Dragon's right eye, comes from the Arabic meaning “the dragon” or “the serpent.” Rastaban, the left eye, is also from Arabic meaning the “Serpents Head.” Draco is an ancient constellation. It is believed that the origin of the constellation is Phoenician.

The most interesting star in Draco is Thuban in the dragon’s tail. Thuban lies about halfway between Mizar in the handle of the Big Dipper and the

Guard stars forming the front edge of the Little Dipper. Polaris, our North Pole star, has not always been our North Pole star. The Earth’s axis precesses, or wobbles like a top, slowly over time. The Earth’s axis always points north, but precession causes our northern axis to trace a circle through the sky making one complete circle every 26,000 years. Six thousand years ago, Thuban was the brightest star located almost directly over the north pole. For the sky watchers of that time Thuban was as fixed in the night sky as Polaris is today. It seems that the Egyptian pyramid of Khufu built around 3000 B.C. at Gizeh was aligned with Thuban such that the star was visible from the bottom of one of the pyramid’s deep shafts. Other pyramids were also built with the pole star Thuban as their focal point. In another 20,000 some years Thuban will be the Earth’s pole star again.

Many cultures have dragon myths. One of the oldest such tales is from the Babylonians, who believed that the dragon constellation was as old as creation itself. It tells of how the god Marduk slew the monster Ti’amat and used his bits to form the universe. It was Marduk who placed Draco in the northern sky so no one would forget the fierce battle to create the universe. Draco is also associated with the dragon that Hercules had to kill so that he could obtain the golden apples of Hera, one of his 12 labors.

In China there are loud noisy dragon ceremonies at certain festivals. The dragon follows a large red ball which represents a pearl or sometimes the Sun or Moon that the dragon just spit out. The ceremony comes from a time when people believed that an eclipse of the Sun or Moon was caused by a dragon about to devour them. The only way to stop the dragon was to make as much noise as possible to frighten the dragon causing him to spit out the Sun or Moon. One last story from the Arabic is not about a dragon. Instead the four stars of Draco’s head are four mother camels protecting a baby camel from two hyenas.
Under the Dome

Leo

To find Leo, “The Lion,” use the pointer stars of the Big Dipper. Draw a straight line through the pointer stars and keep going, they point to the Lions back. Then look for the backward question mark that forms the lion’s head and mane. The question mark ends at the bright star Regulus. Regulus is the heart of the lion. Look just a little to the east and you will see a triangle of stars that represent the lion’s hindquarters and tail.

Leo is another star pattern that actually looks like what it represents, a lion. The constellation of Leo was identified as a lion as far back as 5,000 years ago by the Sumerians and from there passed down to the Babylonians, Greeks, Romans and probably many others. Leo is one of the twelve zodiacal constellations that lie along the ecliptic, the apparent path of the Sun, Moon, and planets through the sky as seen from Earth. In classical representations the lion appears to be lying on the ecliptic guarding his sky kingdom; however, more modern interpretations have him standing. Regulus, meaning “Little King,” is the brightest star in this part of the sky making it easy to identify. However, because it lies along the ecliptic there will be times when a bright planet such as Jupiter, Venus or Saturn may appear close to Regulus. If you see another bright object next to Regulus, it will be a planet or the Moon. The second brightest star in the constellation is Denebola meaning “The Lion’s Tail”.

Since ancient times Leo and Regulus have been associated with kingship and Regulus has long been considered the ruling star of the heavens. The symbolism of Leo is seen in many cultures. It is thought that the Egyptian sphinx associated the royal power of the pharaohs to the celestial symbolism of the lion. The power and strength of Leo is also symbolized as the lion on the royal coat of arms of England.

In Greek mythology Leo is best known as the Nemean Lion. He was the largest and the most ferocious lion that ever lived. He came from the Moon to destroy the Earth. Killing this lion was Hercules’ first of twelve labors. Others had tried to kill the lion, but his skin was so tough that arrows and spears could not pierce it. The cave the lion was living in had two entrances. Hercules sealed off one and then entered the lair through the other. When the lion could not escape from Hercules, he pounced. Hercules caught him at his throat and using his great strength strangled the lion, finally killing him. Hercules then skinned the lion and used it as a protective shield by placing the lion’s head on his own head and wrapping the hide around himself.
Corona Borealis, the Northern Crown, is the prettiest little constellation in the sky and it looks like a crown. The crown is just to the left of Bootes in the sky, bright and easy to see. Early Arabs knew this constellation as the “Dish” or as the “Broken Platter,” because it forms an incomplete circle. In fact, the brightest star in the crown is called Alphecca which is Arabic meaning the “Bright One of the Dish.” Alphecca has also been called Gemma, Latin for gemstone, and the Pearl of the Crown. Many cultures have myths associated with this constellation. The Greeks have called it a wreath. The Chinese call it Kwan Soo meaning a cord and the Australians call it Woomera or Boomerang.

In ancient Greece, these stars were long known as the “Crown of Ariadne.” Ariadne is the daughter of King Minos of the Island of Crete. She is known for saving Theseus, son of the king of Athens in Greece, from her father’s Minotaur. Ariadne was in love with Theseus. Long story short Theseus left Ariadne. She was alone crying on the beach when the god Bacchus came upon her. He thought she was the most beautiful woman he had ever seen. He begged her to marry him. She told him she was done with all men including gods. But Bacchus was in love with her and wouldn’t give up. He gave her the most beautiful golden crown set with dazzling jewels.

They did marry and had a long and happy life together. When Ariadne died Bacchus honored her by placing her crown among the stars.

The Shawnee call the stars of the Northern Crown the “Celestial Sisters.” They have a story about the twelve beautiful sisters who lived among these stars. At night they would come down to Earth and dance in a circle. One night a Shawnee hunter called Algon happened to see the sisters as they danced. He fell immediately and madly in love with the youngest and prettiest sister. He watched them dance night after night. Algon feared that if he approached the sisters, he would scare them away. Using his magical powers Algon turned himself into a field mouse and slipped into their circle. When the youngest sister came close, he changed back into himself and caught her. The other sisters, frightened, fled back to the sky. When the young star-maiden saw who was holding her, she fell immediately in love with him. They were married and had a son. As with all star people Algon’s wife could not remain on Earth forever, and so, one night with a heavy heart she returned to her home among the stars. When the sky people saw how grief-stricken Algon’s wife was they took pity and brought both Algon and their son to live in the sky. The couple and their son lived happily and could forever go back and forth between the sky and the Earth.
**Night Sky Scavenger Hunt**

Find each of the below star patterns and stars in the night sky. You’ll want to wait until 10:00pm or after so that the sky is dark enough to find each one. Use the planisphere you made to help you. Mark which Moon picture best matches the Moon you see in the sky.

### Asterisms
- Big Dipper
- Little Dipper

### Constellations
- Ursa Major
- Ursa Minor
- Leo
- Bootes
- Virgo
- Corona Borealis

### Stars
- Polaris
- Rigel
- Arcturus
- Spica
- Alphecca

### Moon

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<tr>
<td>Full</td>
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