

# Dark Skies

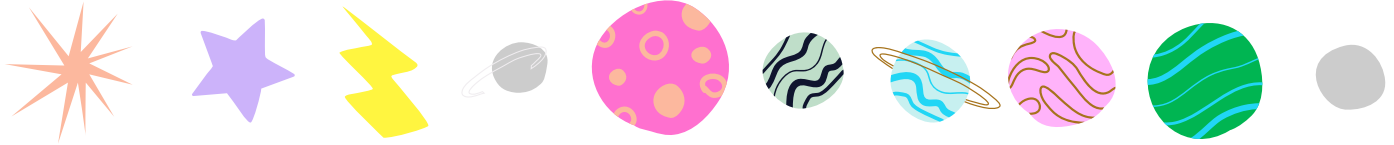


Girl Scouts of Utah

## Dark Skies Patch Program



**girl scouts**   
of utah



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*COMPLETE: Daisies 1 / Brownies 1 / Juniors 2 / Cadettes 2 / Seniors 2 / Ambassadors 2*

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**Thank you to the Utah State Parks Department  
for their assistance with curriculum and resources.**



# ASTRONOMY ACTIVITIES

COMPLETE: Daisies 2 / Brownies 2 / Juniors 3 / Cadettes 3 / Seniors 3 / Ambassadors 3

## ACTIVITY 1: ASTRONOMY CARDS

**Time:** 15-20 minutes

**Supplies:** Four copies of the astronomy cards for every four girls, cut out along the lines. (see appendix)

1. Shuffle the cards.
2. Play Go Fish with the cards, reading the descriptions as you play.  
*To play* Go Fish, give each player 5 cards to start with. The rest should sit face down in a pile. The goal of the game is to get as many groups of the same cards as possible, such as pairs, groups of 3, etc. Girls take turns asking each other if they have a certain card to try and make a pair
3. Keep playing at least until you see all 16 cards.

## ACTIVITY 2: TELL STAR STORIES

**Time:** 15-30 minutes

**Supplies:** Star Stories (see appendix)

1. Civilizations have found patterns in the stars for thousands of years and have told many stories about them. Today, astronomers officially recognize Greek names for constellations, or groups of stars, but other cultures have their own groups and patterns. Stories have been passed down for generations about what they see in the sky.
2. Choose two star stories from the appendix and read them. What did you learn? How is that different from your culture?
3. (Optional) Check out one of these great sites to learn more about star stories to learn more:

<https://www.windows2universe.org/mythology/mythology.html>

[https://nightsky.jpl.nasa.gov/download-view.cfm?Doc\\_ID=666](https://nightsky.jpl.nasa.gov/download-view.cfm?Doc_ID=666)

<https://figuresinthesky.visualcinnamon.com>



# ASTRONOMY ACTIVITIES

COMPLETE: Daisies 2 / Brownies 2 / Juniors 3 / Cadettes 3 / Seniors 3 / Ambassadors 3

## ACTIVITY 3: IN MY MIND'S SKY *From Utah State Parks*

**Time:** 30 Minutes

**Supplies:** Culture cards, blank star chart, marker, paper, pen or pencil

1. Many cultures have studied celestial objects, space, and the physical universe. The constellations we recognize in the night sky today have been handed down through ancient Greek and Roman traditions. Other people around the world and throughout time have developed their own names and ways of looking at and explaining the cosmos.
2. Have the girls look at the culture cards (see appendix) showing the way different cultures have used astronomy to track, record, and use the study of celestial objects to benefit agriculture, navigation, religion, social stature, etc.
3. After viewing the culture cards, each Girl Scout will take a blank copy of a star chart (without constellation outlines) for the current season, outline their own original constellation (not one that is already defined and known), and come up with a short story explaining what it is.
4. Have the Girl Scouts think about how their constellation would be used in a cultural context (agriculture, navigation, religion, etc.). Girls should then write their constellation stories and cultural purpose down.
5. Discuss these topics to help the girls reflect on what they have learned:
  - Astronomers have served different roles in different cultures around the world through time. Some cultures revered astronomers as priests or shamans because they could predict seasonal changes and astronomical events such as solar and lunar eclipses. Many cultures today use astronomy to enhance their societies. What types of jobs use astronomy, and how?
  - Is understanding what you see in the night sky a useful skill? Why or why not?
  - Why is it important to understand different cultural views and uses of the night sky?
  - Make a list of ways understanding what you see in the night sky benefits you personally.
6. Using their star charts with their constellations on them, go outside at night in a dark place and have the Girl Scouts find the constellation they have created. Does it look like what they have drawn? Are all the points of light there? If they can't see their constellation or parts of it are missing, what are the reasons for this?



# ASTRONOMY ACTIVITIES

COMPLETE: Daisies 2 / Brownies 2 / Juniors 3 / Cadettes 3 / Seniors 3 / Ambassadors 3

## ACTIVITY 4: MAKE A STAR WHEEL

**Time:** 15 minutes

**Supplies:** Printed star wheel pages, scissors, tape or stapler

1. Visit <https://skyandtelescope.org/astronomy-resources/make-a-star-wheel/> to print off your star wheel. You will need two pages: the circular sky map and the star wheel outer sleeve. Create your star wheel using the following instructions or using the instructions on the webpage.
2. Print out your star wheel pages.
3. Cut out your star wheel pages. The circular sky map should be a circle and the star wheel sleeve should have a hole cut into the middle, as well as a white rectangle at the bottom.
4. Fold the white rectangle of the star wheel sleeve back to form a pocket. Tape or staple in place.
5. Place the circular sky map in the pocket so that you can see the stars through the hole in the sleeve.
6. To use your star wheel, line up the time and date using the lines at the edge of the circle. The stars that are visible through the hole in the sleeve are those that should be visible in the sky.

## ACTIVITY 5: MAKE A STRAW ROCKET

**Time:** 15 minutes

**Supplies:** Straw rocket template, scissors, tape, straw, sharpened pencil (optional)

1. Visit NASA's straw rocket webpage (<https://www.jpl.nasa.gov/edu/learn/project/make-a-straw-rocket/>) to download and print the straw rocket template. Follow the below instructions or use the image instructions at the webpage.
2. Using the template, cut out the rectangle and the two fins.
3. Wrap the rectangle around the straw to form a tube. Tape to hold the tube together.
4. Fold the fins and tape them to one end of the paper tube to create 4 fins that are at right angles (90 degrees) from each other with the wider side facing away from the center of the tube.
5. Twist the opposite end of the tube to find a point. You may find that a sharpened pencil helps with this. Tape to hold the shape.
6. Place the rocket on your straw. Blow into the straw to launch.
7. For extra fun, try building the rocket in different ways to see if it makes a difference in how far it goes.



# ASTRONOMY ACTIVITIES

COMPLETE: *Daisies 2 / Brownies 2 / Juniors 3 / Cadettes 3 / Seniors 3 / Ambassadors 3*

## ACTIVITY 6: BALLOONIVERSE *from Utah State Parks*

**Time:** 1 hour

**Supplies:** Large space, Copy of Big Bang Theory Timeline, Bicycle pump, Electrical tape, Colored pencils/crayons, Paper, Vacuum cleaner, Safety goggles for each participant, Ear plugs for each participant, Dust mask, and Per participant: Balloon (same sized balloon for everyone), 4 large pompoms, 6 medium pompoms, 10 small pompoms, 10 small foam stars

1. What is the Big Bang? Physicists are people who study how the universe works. In the early 1900s, some physicists suggested that our universe was once a very dense, tiny dot. About 14 billion years ago, an inflation reaction occurred. Space expanded everywhere at once and all the matter in the speck was released. The expansion doubled in size over 90 times in a fraction of a second. This process is how most physicists think our universe was created. It is referred to as the Big Bang Theory, but maybe it should be called the Big Expansion Theory. In fact, our universe is **STILL** expanding and will continue to do so.
2. Explain that they will be creating their own universe simulating the inflation of space, the release of matter, and expansion of the universe (i.e. the Big Bang Theory).
3. Girl Scouts will cram their uninflated balloon as full as they can with the pompoms and foam star elements representing objects in the universe (i.e. stars, planets, comets, asteroids, etc.).
4. Emphasize to Girl Scouts that, though they will be inflating their balloon until it pops, if they were simulating what exactly happened (and is still happening) in the Big Bang, their balloon would inflate forever and never pop. So think of what happens when your balloon pops as a sort of Big Bang snapshot simulation of a single slice of time in the formation of our universe.
5. Ask your Girl Scouts: “What patterns will emerge in your Ballooniverse’s Big Bang?” Have the Girl Scouts form a hypothesis about how the elements will be grouped or scattered after their balloon pops and why. They should write these reasons down on a large sheet of paper (one sheet per team). If the groups are struggling to create a hypothesis, discuss the different characteristics of the materials in the balloon and how these objects may affect each other.



# ASTRONOMY ACTIVITIES

*COMPLETE: Daisies 2 / Brownies 2 / Juniors 3 / Cadettes 3 / Seniors 3 / Ambassadors 3*

## **ACTIVITY 6: BALLOONIVERSE** *continued*

6. Ask the Girl Scouts to draw a picture or map illustrating how their universe materials will be arranged after their Big Bang: (e.g. will the components be grouped randomly, or will there be some sort of predictable order to the way things scatter? Will larger components be clumped together? Will lighter components scatter farther? Will objects form straight lines or swirls? etc.).
7. Once the pictures or maps are complete, have groups of girls pick a corner of the room, or spread out as far as possible from each other in the space you have. Explain that you will inflate each team's balloon until it pops. Remind them that if this were a real simulation of the Big Bang, their balloon would keep expanding for billions of years.
8. Make sure all Girl Scouts put on safety equipment (ear plugs, safety goggles, and a mask) before anyone inflates the balloons.
9. For extra fun, record each girl's Big Bang in slow motion to watch afterwards.
10. Each girl will take turns inflating their balloon with the bicycle pump. Be sure to use the electrical tape or duct tape to secure the balloon to the pump. Have the group members rotate taking a few pumps each until their "Big Bang" happens. Have each group stay in place until all the Big Bangs have taken place and draw a map of the patterns they are seeing.
11. Each group should then take their drawings to their Big Bang site and compare their hypothesis to what actually happened.
12. Next, groups should rotate around the room and compare how each group's universe is similar to and different from their own group's results.





# LIGHT POLLUTION ACTIVITIES

COMPLETE: Daisies 2 | Brownies 2 | Juniors 2 | Cadettes 3 | Seniors 3 | Ambassadors 3

## ACTIVITY 1: LEARN ABOUT LIGHT POLLUTION *from Utah State Parks* (Required)

**Time:** 10 minutes

**Supplies:** none

1. Most of us are familiar with air, water, and land pollution, but did you know that light can also pollute? Using too many, too bright, or misdirected lights are all causes of light pollution. Light pollution can have serious consequences for humans and wildlife. Different types of light pollution include:
  - Glare – excessive brightness that causes visual discomfort
  - Light trespass – light falling where it is not intended or needed
  - Clutter – bright, confusing, and excessive groupings of light source
  - Skyglow – brightening of the night sky over inhabited areas
2. Light pollution is a side effect of industrial civilization. Its sources include exterior and interior lighting, advertising, commercial properties, offices, factories, streetlights, and illuminated sporting venues. Many outdoor lights used at night are inefficient, overly bright, poorly targeted, improperly shielded, and, in many cases, completely unnecessary. There is no need to point lights upward at the night sky. Lights should be directed downward at the space or object that requires illumination and used only where and when they are needed.
3. Misdirected lights and other forms of light pollution have resulted in 80% of the world's population not being able to see the Milky Way from where they live. Our artificial lights are literally washing out our view of the heavens!
4. Humans also need darkness to rest and revitalize. Absence of light sends a critical signal to the body that it is time to rest. Having lights, televisions, or phone or computer screens on at the wrong times alters the body's internal "sleep clock"—the biological mechanism that regulates sleep-wake cycles—in ways that interfere with both the quantity and quality of sleep.
5. One example of an effect of light pollution is the effect on night-migrating birds. Night-migrating birds use the moon and the stars as navigational tools along their migration routes. This behavior naturally draws night-migrating birds to the bright lights in cities along their journey. In these unfamiliar, urban environments, night-migrating birds often fatally collide with tall, brightly lit buildings. Artificial light is especially confusing to birds on foggy or rainy nights, or when cloud cover is low and the birds fly at lower altitudes. (<http://www.flap.org/toronto-lights-out.php>)
6. Another example is sea turtles. Sea turtle hatchlings have an innate instinct that leads them in the brightest direction, which is normally moonlight reflecting off the ocean. Shore-side lighting can cause turtle hatchlings to become disoriented and wander inland instead of out to sea, where they often die of dehydration or predation. (<https://conserveturtles.org/information-sea-turtles-threats-artificial-lighting/>)



# LIGHT POLLUTION ACTIVITIES

COMPLETE: Daisies 2 / Brownies 2 / Juniors 2 / Cadettes 3 / Seniors 3 / Ambassadors 3

## ACTIVITY 2: EXPERIENCE LIGHT POLLUTION *from Utah State Parks*

**Time:** 30 minutes

**Supplies:** Different lights such as flashlights and headlamps, dark space

1. Set up a series of small, battery-operated lights of different colors and intensities on a table or floor in a room. Space the lights unevenly. Alternatively, you can use a constellation projector.
2. Explain to the group that these lights simulate stars, planets, and other celestial objects.
3. Provide a flashlight for each member in the club. Ask them to keep the flashlights turned off until you provide further direction.
4. Have the participants stand in the back of the room and note how well they can see the clarity of the light cluster.
5. Ask one Girl Scout to turn on their flashlight and shine it toward the light cluster.
6. Ask the Girl Scouts how adding a light changed or didn't change the clarity of the light cluster. Discuss the changes.
7. Add an additional flashlight and repeat the two steps above.
8. Repeat until all the flashlights are on.
9. Turn on the room lights.
10. Discuss how this activity relates to human-created light outdoors at night; for example, you can't see the stars as well, nor can you see your surroundings.

## ACTIVITY 3: LIGHT POLLUTION AND OUR PLANET *adapted from Utah State Parks*

**Time:** 30 minutes

**Supplies:** Graphics for Activity 3 in the Appendix

1. Look at the graphic describing the different types of light pollution. Discuss the following questions with the group:
  - What are the different types of light pollution?
  - How many of these types of light pollution do you have around your house? Your school? Your town/city?
2. Look at “Map of Light Pollution Around the World” and “How Light Pollution Has Increased in the United States over Time.” These maps measure sky glow. Discuss the following questions with the group.
  - What do the maps tell you about how the quality of darkness has changed over time?
  - What inferences can you make about Utah based on the map?
  - Why has light pollution increased?
  - When you look at the light pollution maps, why are some places red? Why are some yellow? Why are some places black?
  - What are the positive aspects to these changes? What are the negative aspects?
  - Based on these maps, where are the best locations to see the stars?



# LIGHT POLLUTION ACTIVITIES

COMPLETE: Daisies 2 | Brownies 2 | Juniors 2 | Cadettes 3 | Seniors 3 | Ambassadors 3

## ACTIVITY 4: GLOBE AT NIGHT

**Time:** 15-30 minutes twice

**Supplies:** Globe at Night printouts, pen, device to enter observations

1. Globe at Night is an international organization that studies light pollution by looking at certain constellations throughout the year. They collect data through citizen science, which is when ordinary people collect observations or other information. This is done so that they can get more data than they could if it were just scientists observing. Anyone can do Globe at Night observations and submit them.
2. Go to the Globe at Night website (<https://www.globeatnight.org/>) and look up which constellation you are observing at that time. The constellation changes throughout the year and not every date has a constellation to observe.
3. Go outside on a clear night during the observation period and observe the constellation. You may need to use a star chart or an app to locate the constellation, especially if there is a lot of light pollution.
4. Using the Activity Guide from Globe at Night's website, or their web app on a mobile device, choose the magnitude chart that looks the closest to what you observe. Also make note of the other fields in the packet, such as your coordinates and the time.
5. Make an observation and submit it to Globe at Night.

## ACTIVITY 5: LIGHT POLLUTION TAKE ACTION *adapted from Utah State Parks*

**Time:** 60 – 90 minutes

**Supplies:** Printouts for Activity 5 in the Appendix, pen or pencil, camera or camera phone (optional)

1. Look at the “Light Shielding” graphics and discuss as a group. What are the advantages of shielded light? What kind of light fixture is better for safety in the dark? Why?
2. Take lighting inventories and photos of different areas in your communities. Take your leader or trusted adult with you, and go around and look at your neighborhood, your school, a park, or a shopping area at night. You can use the lighting inventory sheet to track the lights around your area.
3. What do you notice about the number of lights, how much light and how bright each light is putting out, what direction the lights are pointing, etc.
  - Are there any lights you feel are not needed?
  - Are there any lights pointing up at the sky?
  - Are there any lights that do not have full shielding?
  - Are there any lights that shine directly into your eyes so you cannot see well?
  - Are there any lights that shine over into other properties that do not need lighting?
4. You can make a list of lights that are not needed, or are aimed where they are not needed, and take some photos and ask that the folks in charge of those lights change the direction, intensity, number and/or tone of those lights to light only where and when they are needed.



# DARK SKIES ACTIVITIES

COMPLETE: Daisies 1 | Brownies 1 | Juniors 2 | Cadettes 2 | Seniors 2 | Ambassadors 2

## ACTIVITY 1: HOW DARK IS YOUR SKY?

**Time:** 30 minutes

**Supplies:** Star chart (optional)

1. Go outside on a clear night at least an hour after the sun sets. For best viewing, try to choose a night where the moon is not out. To find the moon's phase, check out this calendar:  
<https://www.timeanddate.com/moon/phases/>.
  - Are there any bright stars in the sky? What about faint stars?
  - Can you see any constellations? Which ones?
  - Can you see any planets? How do they look different from stars? Since planets won't appear on your star chart, you can look up where they will be online, such as this website: <https://in-the-sky.org/skymap.php>.
  - Have you ever seen more stars? What about somewhere with less stars?
2. Look up at the sky and discuss the following questions:
3. Discuss what light pollution is nearby. Does your house have any outdoor lights that would cause light pollution? What about streetlights or nearby businesses?

## ACTIVITY 2: THE DARK SKY NEARBY

**Time:** 30-60 minutes

**Supplies:** Star chart (optional)

1. Find a location nearby with less light pollution. An example might be a park at the edge of town.
2. Go outside on a clear night at least an hour after the sun sets. For best viewing, try to choose a night where the moon is not out. To find the moon's phase, check out this calendar: <https://www.timeanddate.com/moon/phases/>.
3. Look up at the sky and discuss the following questions:
  - Are there any bright stars in the sky? What about faint stars?
  - Can you see any constellations? Which ones?
  - Can you see any planets? How do they look different from stars? Since planets won't appear on your star chart, you can look up where they will be online, such as this website: <https://in-the-sky.org/skymap.php>.
  - Have you ever seen more stars? What about somewhere with less stars?
4. Discuss what light pollution is nearby. Does your house have any outdoor lights that would cause light pollution? What about streetlights or nearby businesses?
5. If you looked outside at your house as well, discuss how the sky looks different or similar in these two locations.



# DARK SKIES ACTIVITIES

COMPLETE: Daisies 1 | Brownies 1 | Juniors 2 | Cadettes 2 | Seniors 2 | Ambassadors 2

## ACTIVITY 3: VISIT A DARK SKY PLACE

*Time:* Varies

*Supplies:* Varies

1. Plan your trip by researching local Dark Sky Parks and Places on the International Dark Sky Association's website (<https://www.darksky.org/our-work/conservation/idsp/finder/>) or by looking in the appendix. Be sure to use the guidelines for travel in Volunteer Essentials and Safety Activity Checkpoints. Some dark sky parks and places can be visited in a day trip from a major city and others may require an overnight visit.
  - How does the sky look different here from your house? From your town?
  - How many bright stars are there in the sky? How many faint stars?
  - Can you see the Milky Way (a band of concentrated stars that crosses the sky)?
  - Can you see any constellations? Which ones?
  - Can you see any planets? How do they look different from stars? Since planets won't appear on your star chart, you can look up where they will be online, such as this website: <https://in-the-sky.org/skymap.php>.
  - What do the outdoor lights look like? Are they present at all?
2. Visit a Dark Sky Place and observe the night sky there. Discuss the following questions:
3. Optional: participate in a stargazing or other Dark Sky program at the Dark Sky Park or Place.

## ACTIVITY 4: TAKE A VIRTUAL DARK SKY TOUR

*Time:* 3.5 hours

*Supplies:* Device to play video, access to the internet

1. Check out a recorded virtual Dark Sky event by visiting the Utah State Park's Facebook page and viewing this video:  
<https://www.facebook.com/465249836849485/videos/363930564637606>
2. Discuss with your Girl Scouts:
  - What surprised them about the video?
  - What did they learn?
  - What was their favorite part?



# APPENDIX

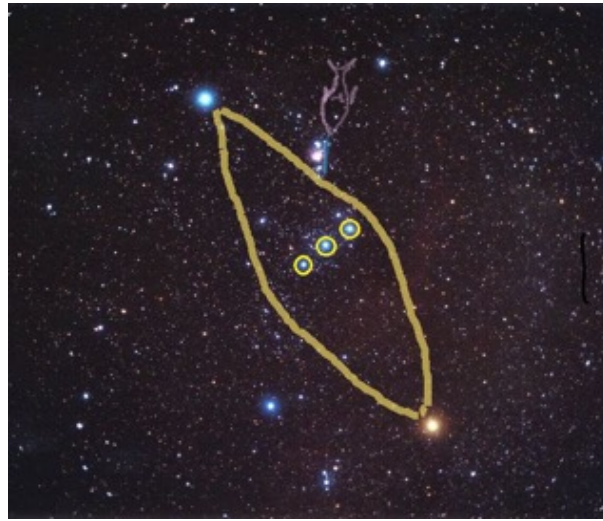
## Star Stories Through Time and From Around the World (Astronomy Activity 2)

*Compiled for the Girl Scouts of Utah Dark Sky Patch Program.*

*By Justina Parsons-Bernstein, Utah State Parks Dark Sky Initiative Coordinator*



Notice that in Australia, this constellation appears upside down from how people in the Northern Hemisphere, including the United States, see it.



Here is the Djulpan constellation with the canoe, three brothers and the kingfish outlined.

The image above left shows the constellation Orion, as it is called in the Greco-Roman tradition that many European and Euro-American people follow. Note that the position of the constellation appears upside down from how people in the Northern Hemisphere (such as the United States) see it. Australia is in the Southern Hemisphere. The image above right shows the outline of the constellation that goes with the story below.

The Yolngu people of the Northern Territory of Australia know this constellation as **Djulpan**. A traditional Yolngu story tells how three brothers of the King-fish (Nulka) clan went fishing, but all they could catch were King-fish. Traditional cultural laws forbade them from eating the type of fish for which their clan was named, so the brothers had to throw the King-fish back into the water. Eventually, one of the brothers became so hungry that he decided to break the law. He decided to eat the next King-fish he caught—which he did. The Sun-woman (Walu) saw this and was so angry at the boy for breaking the law that she created a waterspout that lifted the three brothers and their canoe right up into the sky. This is where you can still see them today. The three brothers are the three stars across the center of the canoe, and the Orion nebula is the fish they caught trailing on their fishing line in the water. Thus, this constellation is a constant reminder that people should obey the laws of their culture.

In classical Greco-Roman mythology, the three stars in this constellation represent Orion's belt. Orion's sword is actually a nebula that is only 1000 light-years away from us and where new stars are being born. Also take note that at the bottom right (the bow of the canoe) is the red giant star Betelgeuse and to the top left (the stern of the canoe) is the star Rigel.

Based on source from:

<http://emudreaming.com/Examples/djulpan.htm#:~:text=The%20three%20brothers%20are%20the,better%20not%20break%20the%20law!>

Original Photo: NASA.



## The Seven Dancers Constellation (An Oneida Winter Night Sky Story)



*The Oneida's Seven Dancers Constellation. This constellation is also known as the Pleiades in the Greco-Roman tradition.*

There once was an Oneida village by the river. There were eight boys that played together all the time. Every day they met at the same place; they even had their own chief. Whenever they met, the chief would play his drum and the others would start to dance. When they got tired of dancing, they would eat.

One day the chief said, "Tomorrow we will have a feast and I want to ask for different kinds of foods to be shared." One boy asked for corn soup. His mother said, "Why do you want to take it over there when you can eat it here? No, you can't have any." One boy asked for deer meat. His mother got angry with him and said, "Why do you want to take the deer meat over there? No, you can't have any." One boy asked for corn and his mother said, "No, we don't have any."

All the boys met where they played all the time. Then they told their chief that they couldn't have a feast because their mothers wouldn't let them bring any food. The chief said to them, "Don't feel bad, I'll play my drum and you can still dance." The boys said, "We are too hungry to dance." The chief said, "Don't think about anything, just dance, and when I play faster you dance faster."

The boys began to dance; they danced so fast they began to rise up and soon they were over the trees. Finally, the parents looked up and saw their children dancing so far off the ground. They hollered at the boys to come back. Their chief said, "Don't look down just dance faster." One boy looked down and he fell back down. He looked like a falling star as he fell.

To this day, if you look up, you can still see the seven dancers dancing in the night sky.

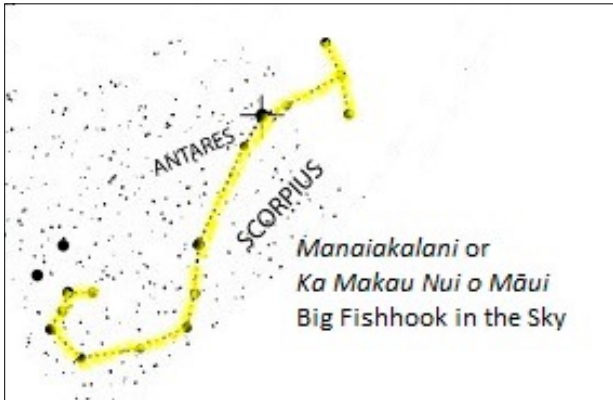
A Mid-Winter Ceremony follows the telling of this tale in the Oneida Tradition.

From the Source: <https://oneidalanguage.ca/story/seven-dancers/>

Original Photo: NASA.

# Māui's Big Fishhook in the Sky

*(A Native Hawaiian Constellation that Interacts with the Milky Way)*



Fishhook Outlined on Top of NASA Star Chart

Photo of Fishhook in Dark Space of Milky Way by Akira Fujii

In the Native Hawaiian tradition, there is a beautiful constellation that has a direct interaction with the Milky Way. There are a couple of names for this constellation: Ka Makau Nui o Māui or Manaiakalani, which translate as “The Big Fishhook of Māui.” The Greco-Roman name for this constellation is Scorpius. Ka Makau Nui o Māui is shaped like a fishhook embedded in a dark space in the Milky Way. The dark space is called I’a, which translates to “fish”, or more poetically and descriptively, the dark space is called I’a-lele-i-aka, which translates to “fish leaping in shadows”. The character the fishhook belongs to is called Māui. Māui is considered a “superhero and demigod” for the people of Hawaii and other Polynesian Islands. In Hawaii, “if Māui can hook the fish Luehu on the night of Lono, he can draw the islands together.”

Māui had many other interesting interactions with the cosmos. In one story, Māui noticed that people could not stand up straight and that plants and trees were stunted and leaves were pressed flat because the sky was too low and was inhibiting the growth of living things. Māui wanted to ease the suffering of the living things on earth and went to his father for help in thinking of a way to raise the sky. Māui and his father laid down on their backs and used their super strength to start pushing upward against the sky. They pushed and pushed until the sky was high enough up to allow living things to grow healthily upward. This is a tale that emphasizes the importance of family cooperation.

In another tale, Māui's mother, the goddess Hina is upset because the sun is not staying up in the sky long enough to properly dry her kapa cloth. Kapa cloth is a type of soft cloth made from pounded bark. To appease his mother, Māui climbed up and hid inside the top of the Haleakala volcano. He waited for the sun to rise and then jumped out and captured the sun's rays with special ropes woven from his sister's hair. The sun's rays were actually its arms and Māui threatened to keep the sun bound up unless it agreed to stay up for a longer amount of time each day. The sun agreed to slow its travels across the sky. This increased the growing season for the people of Hawaii and also enabled them to dry their kapa cloth properly. This is another example of the importance of family members helping each other.

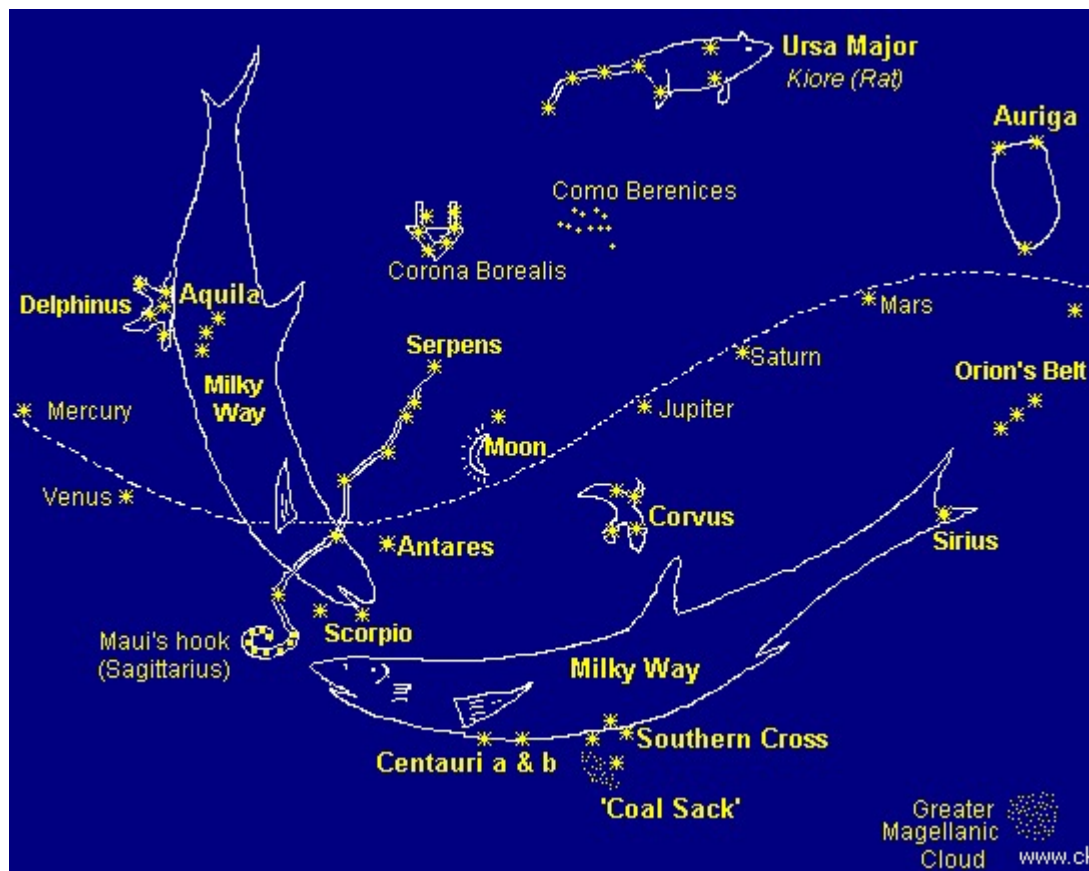
From the Sources: <https://keolamagazine.com/culture/constellations-hawaiian-style/>  
[http://archive.hokulea.com/ike/hookele/hawaiian\\_star\\_lines.html](http://archive.hokulea.com/ike/hookele/hawaiian_star_lines.html)  
<https://www.tourMāui.com/Māui-demigod/><https://www.pacificwhale.org/blog/inside-a-unique-tour-of-Māuis-night-sky/>

Original Star Chart: NASA. Chart illustrated over by Justina Parsons-Bernstein



## Culture Cards (Astronomy Activity 3)

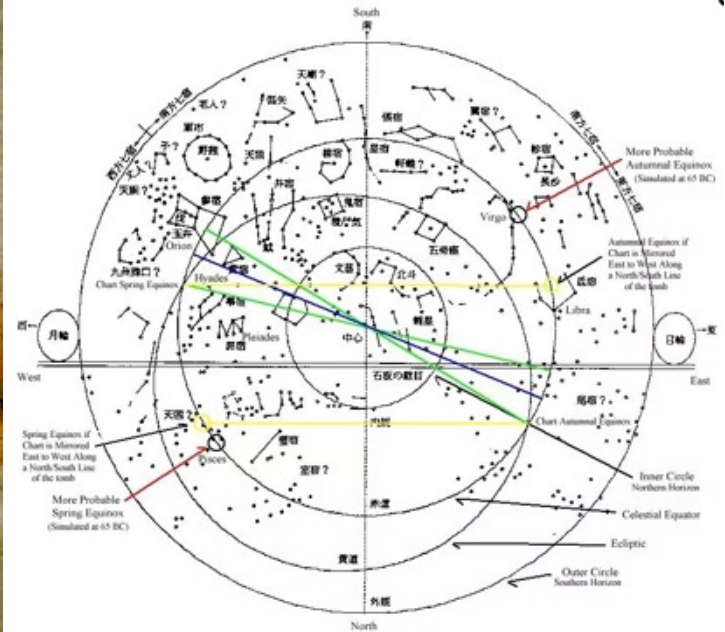
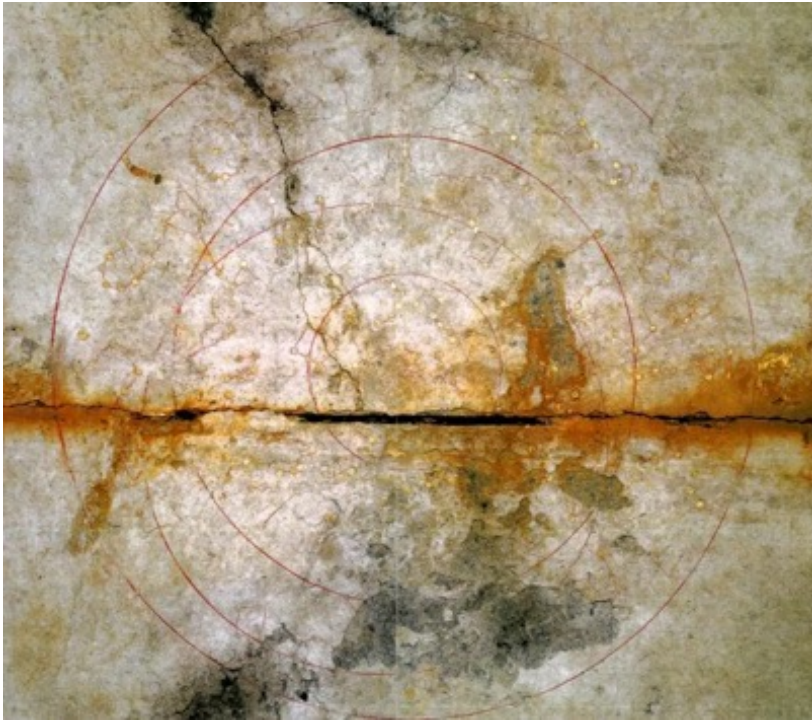
### Pukapukan Star Chart



Pukapuka is a beautiful remote island in the Cooks Islands group in the Pacific Ocean. The Island harbors a lagoon with water so clear you can see great forests of coral deep below the ocean's surface. Humans have inhabited the island since at least 300 BC. The Pukapukans are famous sailors and navigators. This version of a Pukapukan star map shows the names of the constellations we use in the United States, but with the Polynesian references using the legends and ocean creatures with which they were familiar. For instance, they saw the Milky Way as two large sharks. What else might you be able to tell is important to Pukapukan culture by their constellations outlined on this chart?

<http://www.ck/pukapuka.htm>

## Astronomical Chart on the Ceiling of the Kitara Tomb



This star chart carved into the ceiling of the Kitara Tomb located in Asuka, Japan, is believed to be one of the world's oldest. The map of the night sky charts 68 constellations with the stars represented in gold leaf. Three concentric circles are drawn with red pigment, showing the movement of celestial objects, one of which is the sun. One thing that has confused researchers is the area of sky the chart depicts. Some researchers say the chart depicts the night sky as it was in China 1,500 to 2,100 years ago. Other researchers think the chart depicts night sky as it was in Korea about 2,000 years ago. The Kitara chart was redrawn with explanations by University of Iowa research fellow Steve Renshaw. Can you find the sun on this star chart?

<https://www.cnet.com/news/mysterious-ancient-star-chart-shows-foreign-skies/>

## First Nations Star Chart



These are the constellations of the Ojibway, Cree, Blackfoot, and other First Nations of what is now known as Canada. From the names of these constellations, what are some things you can tell are important to folks from these cultures? <https://wildernessastronomy.com/resources/starchart-first-ever-overview-of-the-canadian-constellations/>



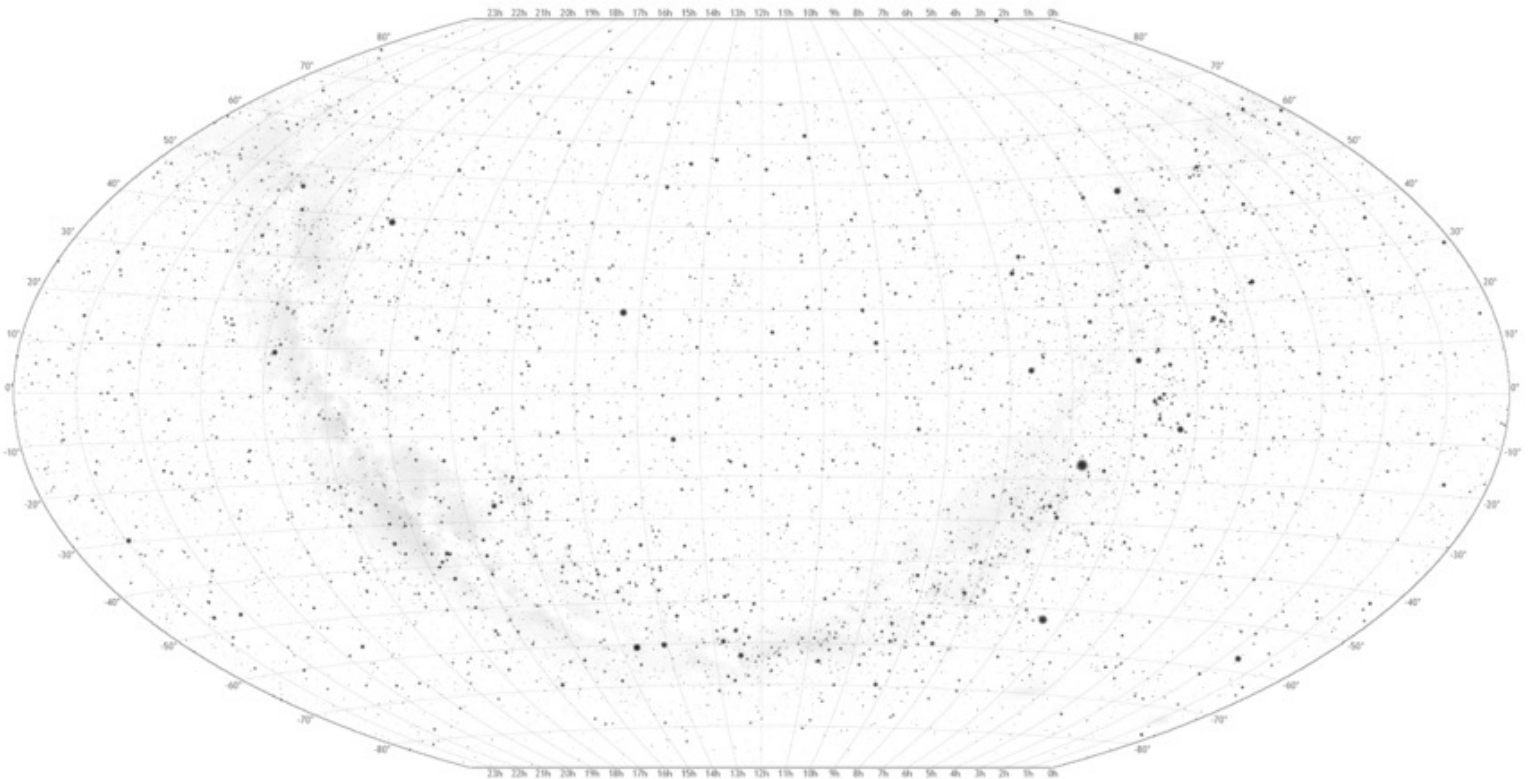
## Incan Nebulae Astronomical Chart



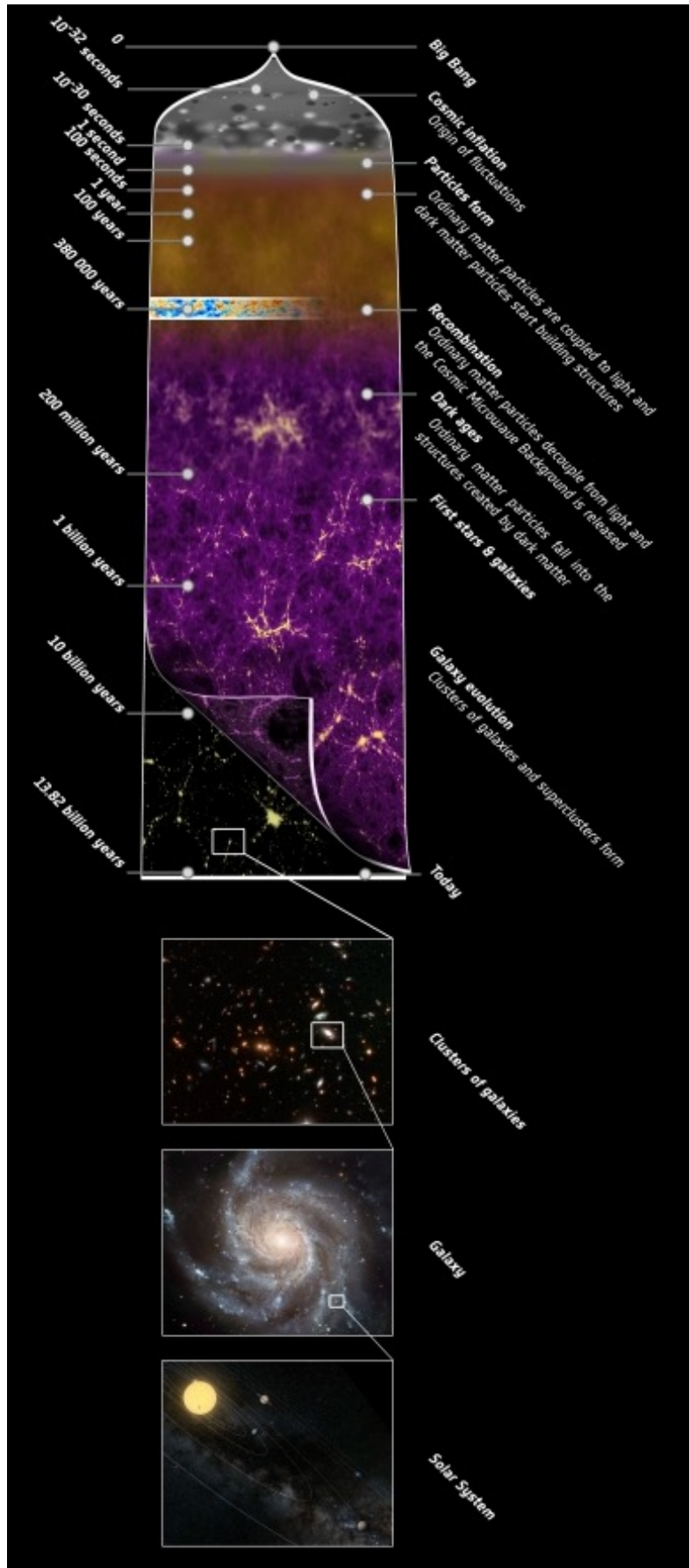
The Incas grouped constellations into two different types – luminous and dark. The first was made up of sparkling stars that depicted geometric forms in the sky. These luminous constellations were seen as inanimate. The other kind – the dark cloud constellations – were contained within the dark blotches of the Milky Way, and were considered living forms, representing animals the Incas knew. These dark patches represented the silhouettes of animals that came to drink from the waters of celestial river, obscuring the heavenly glow of Mayu.

<https://futurism.com/the-dark-constellations-of-the-incas>

## Blank Star Chart (Astronomy Activity 3)



# Big Bang Diagram (Astronomy Activity 6)



[https://www.nasa.gov/mission\\_pages/planck/multimedia/pia16876b.html#.YEadjp1KiU](https://www.nasa.gov/mission_pages/planck/multimedia/pia16876b.html#.YEadjp1KiU)

# Light Pollution and Our Planet Graphics

(Light Pollution Activity 3)

## Types of Light Pollution



**Glare**



**Urban Sky Glow**



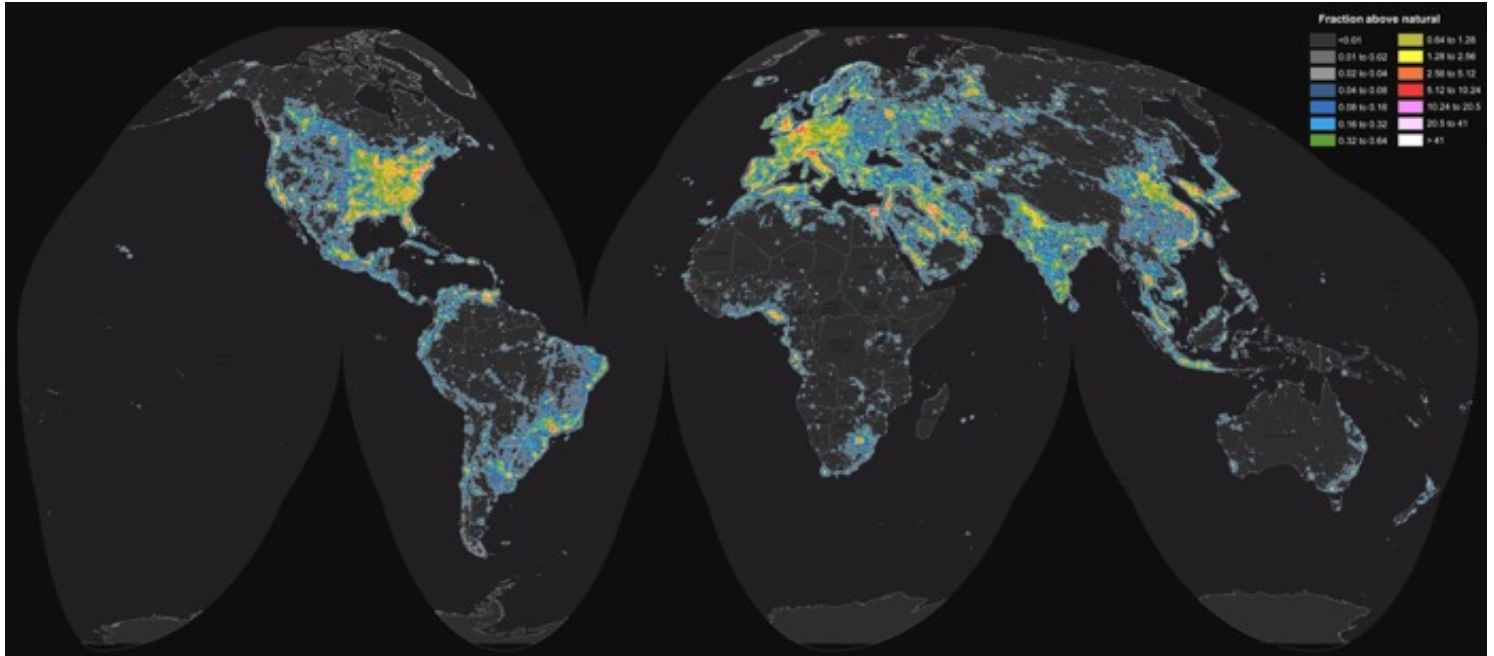
**Trespass**

Florida Atlantic University, Department of Physics. (2013). The Problems of Light Pollution — Overview,

<http://physics.fau.edu/observatory/lightpol.html>

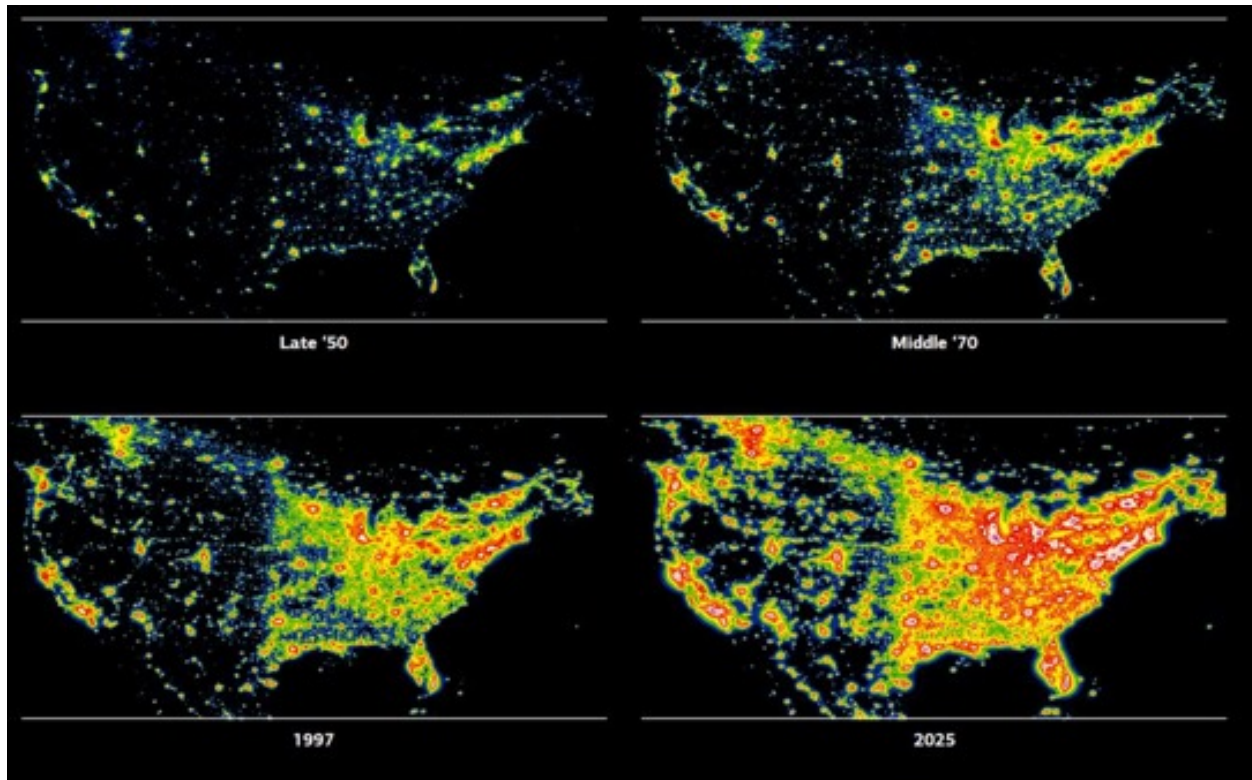


## Map of Light Pollution Around the World



<https://www.canadiangeographic.ca/article/new-map-highlights-global-problem-light-pollution>

## How Light Pollution Has Increased in the United States over Time



<https://archive.curbed.com/2017/4/26/15442432/photography-dark-sky-light-pollution-skyglow>

# Light Shielding Graphic (Light Pollution Activity 5)

**Shielded lights help bring out the stars.**

**Exposed Light**      **Exposed Light**      **Partial Shield**      **Full Shield**

**Simple steps preserve dark skies:**

- Light only **where** you need it.
- Light only **when** you need it.
- Shield** light fixtures to **direct** light downward.
- Use the **minimum** amount of light necessary.
- Use light bulbs with an **amber color temperature** of 3000-Kelvin or lower.
- Keep indoor light **inside**. Close blinds and curtains when lights are on at night.

**LED is not always dark sky friendly.**  
LED lights can be overly bright and blue white.  
Dark sky friendly lights have lower lumens (less bright) and lower Kelvins (warm in color).

**Lumens = brightness of the light.**

Low      Bright

450 L    600 L    800 L    1100 L    1600 L    2000 L    2600 L

← Lower outdoor light is dark sky friendly. ←

**Kelvin = color spectrum of the light.**

Warm white      Pure white      Cool white

1000 K    2000 K    3000 K    4000 K    5000 K    6000 K    7000 K

← Warm light is dark sky friendly. →

**Light courtesy in the park.**

Poor Unshielded light      Better Partial light shield      Best Full light shield

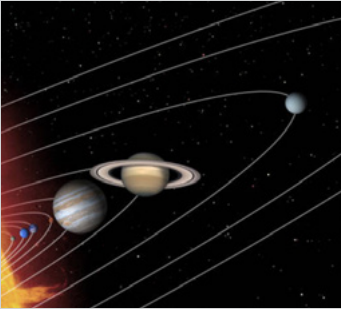
**Dark Sky Network**  
PARKS



# Go Fish Astronomy Cards

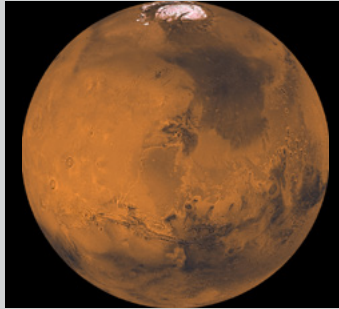
## PLANET

A large object that goes around the sun and has its own gravity.



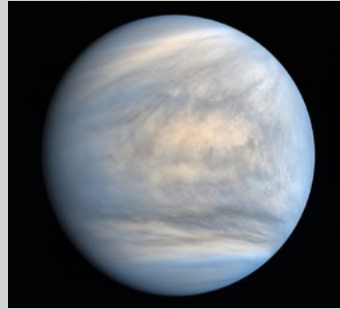
## MARS

The red planet, next to Earth, and further away from the sun.



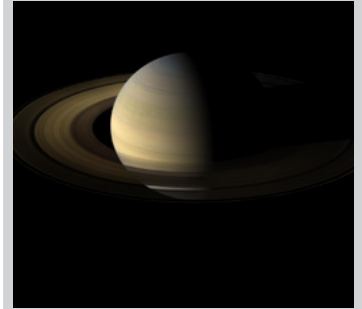
## VENUS

The planet next to Earth and closer to the sun.



## SATURN

A large planet with many rings.



## JUPITER

A large planet with many moons.



## MOON

Something that goes around a planet (orbits), like our moon.



## SUN

The star in our solar system.



## STAR

A burning ball of gas in space.



## CONSTELLATION

A group of stars that people have named.



## GALAXY

A big group of stars and other things in space.



## MILKY WAY

Our galaxy, shaped like a spiral with arms.



## NORTH STAR

(POLARIS)  
The star in the Northern Hemisphere that is always in the same spot North.



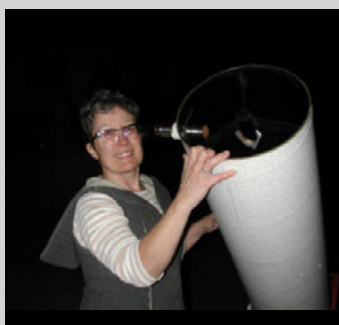
## BIG DIPPER

A group of stars that look like a cup with a long handle.



## ASTRONOMER

Someone who studies or observes space.



## TELESCOPE

A tool used to see stars and other objects closer.



## BINOCULARS

A tool used to see the moon and some stars closer.



## Lighting Inventory (Light Pollution Activity 5)

Type of light	Drawing of fixture	Is it shielded?	Brightness: too bright, not bright enough, just right	Warm or cool?	How many fixtures?	Purpose?	Is it contributing to light pollutions?

## **Dark Sky Locations in Utah (Dark Skies Activity 3)**

### **Utah State Parks with Dark Sky Designations**

Visit Utah State Parks to experiences dark skies! Check out these webpages and social media links for upcoming events and activities. You can also watch past dark sky event videos on the Utah Stae Parks' Facebook pages, and you can also come and just view the stars on your own. You don't need fancy equipment. Your eyes and even a pair of binoculars make stargazing fun!

**Antelope Island State Park (a designated International Dark Sky Park)—near Syracuse, Utah**  
<https://stateparks.utah.gov/parks/antelope-island/dark-skies/> or <https://www.facebook.com/AntelopeIslandSP>

**Bear Lake State Park (in process of qualifying to be an International Dark Sky Park)--**  
<https://stateparks.utah.gov/parks/bear-lake/> or <https://www.facebook.com/BearLakeStatePark>

**Dead Horse Point State Park (a designated International Dark Sky Park)—near Moab, Utah**  
<https://stateparks.utah.gov/parks/dead-horse/night-sky/> or <https://www.facebook.com/DeadHorsePointStatePark>

**East Canyon State Park (a designated International Dark Sky Park)—near Morgan, Utah and Jeremy Ranch, Utah**  
<https://stateparks.utah.gov/parks/east-canyon/> or <https://www.facebook.com/eastcanyonstatepark>

**Fremont Indian State Park (a designated International Dark Sky Park)—near Richfield, Utah**  
<https://stateparks.utah.gov/parks/fremont-indian/> or <https://www.facebook.com/fremontindian>

**Goblin Valley State Park (a designated International Dark Sky Park)—near Green River, Utah and Hanksville, Utah**  
<https://stateparks.utah.gov/parks/goblin-valley/night-skies/> or <https://www.facebook.com/GoblinValleyStatePark>

**Goosenecks State Park (a designated International Dark Sky Park)—near Bluff, Utah and Mexican Hat, Utah**  
<https://stateparks.utah.gov/parks/goosenecks/> or <https://www.facebook.com/GoosenecksSP>

**Gunlock State Park (in process of qualifying to be an International Dark Sky Park)—near Gunlock, Utah in St. George Area**  
<https://stateparks.utah.gov/parks/gunlock/> or <https://www.facebook.com/GunlockStatePark>

**Jordanelle State Park (a designated International Dark Sky Park)—near Heber, Utah**  
<https://stateparks.utah.gov/parks/jordanelle/> or <https://www.facebook.com/JordanelleSP>

**Kodachrome Basin State Park (a designated International Dark Sky Park)—near Cannonville, Utah**  
<https://stateparks.utah.gov/parks/kodachrome-basin/> or <https://www.facebook.com/KodachromeBasinStatePark>

**Rockport State Park (a designated International Dark Sky Park)—near Peoa, Utah**  
<https://stateparks.utah.gov/parks/rockport/> or <https://www.facebook.com/RockportStatePark>

**Snow Canyon State Park (in process of qualifying to be an International Dark Sky Park)—near Ivins, Utah in St. George Area**

<https://stateparks.utah.gov/parks/snow-canyon/> or <https://www.facebook.com/FriendsofSnowCanyon>

**Steinaker State Park (a designated International Dark Sky Park)—near Vernal, Utah**

<https://stateparks.utah.gov/parks/steinaker/> or <https://www.facebook.com/SteinakerStatePark>

**Wasatch Mountain (in process of qualifying to be an International Dark Sky Park)  
—near Midway, Utah**

<https://stateparks.utah.gov/parks/wasatch-mountain/> or <https://www.facebook.com/WasatchMountainStatePark>

## **Utah National Parks and Monuments with Dark Sky Activities and Star Parties**

**Arches National Park (a designated International Dark Sky Park) – near Moab, Utah**

<https://www.nps.gov/arch/learn/nature/lightscapes.htm> or <https://www.facebook.com/ArchesNPS>

**Bryce Canyon National Park (a designated International Dark Sky Park) – near Panguitch, Utah**

<https://www.nps.gov/brca/learn/nature/lightscapes.htm> or <https://www.facebook.com/BryceCanyonNPS>

**Canyonlands National Park (a designated International Dark Sky Park) – near Moab, Utah**

<https://www.nps.gov/cany/planyourvisit/stargazing.htm> or <https://www.facebook.com/CanyonlandsNPS>

**Capitol Reef National Park (a designated International Dark Sky Park) – near Torrey, Utah**

<https://www.nps.gov/care/learn/nature/night-sky.htm> or <https://www.facebook.com/CapitolReefNPS>

**Cedar Breaks National Monument (a designated International Dark Sky Park)**

**– near Cedar City, Utah**

<https://www.nps.gov/cebr/planyourvisit/experience-dark-night-skies.htm> or <https://www.facebook.com/CedarBreaksNPS>

**Dinosaur National Monument (a designated International Dark Sky Park) – near Vernal, Utah**

<https://www.nps.gov/dino/planyourvisit/stargazing.htm> or <https://www.facebook.com/DinosaurNPS>

**Glen Canyon National Recreation Area/Rainbow Bridge National Monument (a designated International Dark Sanctuary) – near Page, AZ**

<https://www.nps.gov/glca/learn/nature/night-skies.htm> or <https://www.facebook.com/glencanyonra/>

**\*Great Basin National Park (a designated International Dark Sky Park) – near Baker, Nevada**

<https://www.nps.gov/grba/planyourvisit/great-basin-night-sky.htm> or <https://www.facebook.com/GreatBasinNPS>

**Hovenweep National Monument (a designated International Dark Sky Park) – near Bluff, Utah**

<https://www.nps.gov/hove/planyourvisit/stargazing.htm> or <https://www.facebook.com/HovenweepNPS>

**Natural Bridges National Monument (a designated International Dark Sky Park)**

**– near Blanding, Utah**

<https://www.nps.gov/nabr/learn/nature/darkskypark.htm> or <https://www.facebook.com/NaturalBridgesNPS>



**Timpanogos Cave National Monument (a designated Urban Night Sky Place)**

– near American Fork, Utah

<https://www.nps.gov/tica/index.htm> or <https://www.facebook.com/timpanogoscavenps>

**Zion National Park (in process of qualifying to be an International Dark Sky Park) – near Springdale, Utah**

<https://www.nps.gov/zion/learn/nature/nightskies.htm> or <https://www.facebook.com/zionnps>

## **Astronomy Clubs and Other Entities that Hold Dark Sky Events and Star Parties**

Cache Valley Astronomical Society (Logan region): <https://cvas-utahskies.org/>

Ogden Astronomical Society (Ogden region): <http://ogdenastronomy.org/> or

<https://www.facebook.com/Ogdenastronomy>

Salt Lake Astronomical Society (Stansbury Park and SLC region):

<http://slas.us/> or <https://www.facebook.com/UtahStarParty>

Utah Astronomy Club (northern Utah region):

<https://www.facebook.com/groups/638816972950322>

University of Utah – Dept. of Physics & Astronomy / South Physics Observatory (SLC region):

<https://observatory.astro.utah.edu/> or <https://www.facebook.com/SouthPhysicsObservatory>

Clark Planetarium (SLC region): <https://slco.org/clark-planetarium/> or <https://www.facebook.com/ClarkPlanetarium>

[ClarkPlanetarium](https://www.facebook.com/ClarkPlanetarium)

Utah Women Astronomical Society (SLC region):

Utah Women Astronomical Society Webpage or

<https://www.facebook.com/groups/utahwomenastronomicalsociety>

Utah Valley Astronomy Club (Utah County region):

<http://www.uvac.us/> or <https://www.facebook.com/groups/utahvalleyastronomyclub/>

BYU Astronomical Society (Provo area):

<https://physics.byu.edu/clubs/astrosoc/home> or <https://www.facebook.com/byuastro>

Carbon County Star Parties (Carbon County region):

<https://www.go-astronomy.com/astronomy-club.php?ID=772> or <https://www.facebook.com/groups/CarbonCountyStarParties>

[CarbonCountyStarParties](https://www.facebook.com/groups/CarbonCountyStarParties)

RedRock Astronomy (Private business – Moab region): <http://moab-astronomy.com/>

Moab Astronomy Tours (Private business – Moab region):

<https://www.moabastronomytours.com/> or <https://www.facebook.com/moabastronomytours>

Dark Ranger Telescope Tours (Private business – Bryce Canyon/southern Utah region):

<https://www.darkrangertele scopetours.com/> or <https://www.facebook.com/darkrangertele scopetours>

Stellar Vista Observatory (Kanab region):

<https://stellarvistaobservatory.org/> or <https://www.facebook.com/stellarvistaobservatory>

St. George Astronomy Group (St. George region):

<https://sgag.club/> or <https://www.facebook.com/groups/533176590209756>