Constellation at Your Fingertips: Crux

Grades: 3 – 6

Overview: Constellation at Your Fingertips introduces the novice constellation hunter to a method for spotting the main stars in the constellation, Crux, the Cross. Students will make an outline of the constellation used to locate the stars in Crux. This activity will engage children and first-time night sky viewers in observations of the night sky. The lesson links history, literature, and astronomy. The simplicity of Crux makes learning to locate a constellation and observing exciting for young learners. All materials for GLOBE at Night are available at http://www.globeatnight.org

Purpose: Students will look for the faintest stars visible and record that data in order to compare data in GLOBE at Night across the world. In many cases, multiple night observations will build knowledge of how the "limiting" stellar magnitudes for a location change overtime. Why is this important to astronomers? Why do we see more stars in some locations and not others? How does this change over time? The focus is on light pollution and the options we have as consumers when purchasing outdoor lighting. The impact in our environment is an important issue in a child's world.

Crux is a good constellation to observe with young children. The constellation Crux (also known as the Southern Cross) is easily visible from the southern hemisphere at practically any time of year. For locations south of 34°S, Crux is circumpolar and thus always visible in the night sky. It is also visible near the horizon from tropical latitudes of the northern hemisphere for a few hours every night during the northern winter and spring. Because Crux is not visible from most latitudes in the northern hemisphere, it has no Greek or Roman myths associated with it. Crux was used by explorers of the southern hemisphere to point south since the south celestial pole is not marked by any bright star as it is at the north celestial pole.

Crux lies within the Milky Way and is surrounded by Centaurus, the Centaur, on three sides. Centaurus is one of the brightest and largest constellations in the southern sky. The two brightest stars in Centaurus, Alpha and Beta Centauri, are often referred to as the "Southern Pointers" or just "The Pointers", allowing people to easily find the constellation of Crux. (Alpha Centauri is also the 4th brightest star in the night sky.) At the foot of the cross in Crux, you will find Acrux, the brightest star of this constellation. Acrux is actually a double-star. Crux contains at least ten open clusters visible with small telescopes, despite the constellation's small area.

U.S. National Science Education Standards: **Science Inquiry (selected standards not limited to the following)**

1. Understanding of scientific concepts
2. An appreciation of "how we know" what we know in science
3. Understanding of the nature of science
4. Skills necessary to become independent inquirers about the natural world

Arizona Science Standards:

ADE Grade 1 Earth and Space
PO 2. Compare celestial objects (e.g., Sun, Moon, stars) and transient objects in the sky (e.g., clouds, birds, airplanes, contrails).
PO 3. Describe observable changes that occur in the sky, (e.g., clouds forming and moving, the position of the Moon).

ADE Grade 5 Life Science
PO 3. Describe various objects in the sky (e.g., asteroids, comets, stars, meteors/shooting stars).

ADE Grades K-5
Process Skill of observation is essential and designated at all grade levels

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Objectives:

- Work individually and report in a collaborative group
- Locate and observe the major stars in Crux to understand how magnitude is effected by light pollution
- Communicate results of their investigation to an audience of peers
- Use latitude and longitude coordinates to report the location from which they took their observation
- Locate the constellation Crux using stellar map
- Determine the magnitude of the faintest visible stars in their location
- Analyze the spatial data collected
- Draw conclusions from studying the mapped observations

Time to Do Activity:
2 or 3 sessions (one for the constellation design page and lesson introduction and one for data collection)
Teacher set up time required to gather materials (one hour)

Materials needed:
fabric paint - 2 colored tubes of GLOW Tulip brand fabric paint (or other glow in the dark paint) per student group, Crux pdf patterns per student (attached) , transparencies (one per student), flashlights, a few Q-tips per student, book and/or print out from the web on the mythology

Preparation/Prerequisites: The first lesson is completed in school with all materials needed. The second lesson can only be completed in a nighttime observation. It is recommended that you contact the local astronomers group for volunteers that can assist with laser lights to guide the observations. As long as this is arranged, ask them to bring telescopes to share the wonders of the sky with the class/children. Ignite the awe and wonderment.

Background Information -- teacher/students (online/offline)

- Contact your local section of the International Dark-Sky Association or amateur astronomers association for support/class visits on the impact of lighting on astronomical observations: http://www.darksky.org

- Check out from your school library *The Constellations: Stars & Stories* by Chris Sasaki. It describes several of the major constellations like Orion, Cygnus, Leo and Crux.

- http://en.wikipedia.org/wiki/Crux

- http://www.globeatnight.org/learn_cruxmyth.html

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Lesson Sequence

Activator: Read the history of Crux, the Cross, at http://www.GLOBEatnight.org/learn_cruxmyth.html.
Formative Assessment: Brainstorm/respond to "Why do we see more stars in some locations and not others? How does this change over time?"
Activity: Do craft and read on history and related literature.
Observation: Submit observation to GLOBE at Night or collect observation from multiple nights.
Summative Assessment: Locate Crux in the night sky and draw the bright stars.

Session A

1) First, place the Crux tracing pattern with the transparency on top, so the transparency covers the entire constellation.
2) After placing these on a flat surface, trace the inner constellation pattern with the first color tube of glow-in- the-dark fabric paint, and follow the pattern by creating lines and circles on the transparency where indicated. The inner pattern is the constellation of stars connected by straight lines and circles.
3) When you're finished with the inner constellation, it is time to trace the outer more imaginative outline of the constellation with the second, different-colored tube of glow-in-the-dark fabric paint.
4) If you blur some lines or make a minor mess while tracing, try using Q-tips to fix them.
5) When you are finished - DO NOT SKIP THIS - allow the transparency to dry for AT LEAST a couple of hours in a brightly lit area before attempting to do the activity.

Session B

1) After the glow-in-the-dark fabric paint on the transparency has completely dried for at least a few hours and been under strong light for at least 45 minutes, a UV light for a 30 seconds or an LED light for a minute or two, you are ready to take the transparency outside to find Crux.
2) During the Crux observation time observe the major stars and match the pattern before you compare for data collection.
3) The Crux Finder Charts from the GLOBE at Night Web site will also help locate the general area in which to find Crux. (http://www.GLOBE.gov/GaN/crux_finder.html)
4) When you have found the general area, hold up the transparency with the constellation pattern on it at arm's length. Match the pattern you have drawn with the stars in the constellation Crux. You may have to tilt or turn the transparency to align the pattern correctly with the stars.
5) The constellation pattern has been drawn so the stars in the constellation will be visible within the circles drawn on the transparency itself, allowing the constellation pattern to be recognizable to even the most novice night-sky observers.
6) The transparency with the glow-in-the-dark constellation pattern should glow for 5 to 10 minutes. Be sure to take an LED flashlight with you so that you can "recharge" the transparency for continuous use. However, be careful not to loose your eyes' adaptation to the dark sky.

Session C

- Using the data collected and the data online from around the world, students will be able to compare the similarities of magnitudes in big cities and rural areas. Big cities produce more light and cause fewer stars to be visible.
- Students will discuss "Why do we see more stars in some locations and not others? How does this change over time?"
- Students will locate independently Crux and recognize the difference in magnitude of the stars.

Credits: The original activity was created by Natasha Kopsie and Connie Walker at the National Optical Astronomy Observatory (NOAO) for the GLOBE at Night program. NOAO is operated by the Association of Universities for Research in Astronomy Inc. (AURA), under a cooperative agreement with the National Science Foundation.

GLOBE at Night is a collaboration between The GLOBE Program; the National Optical Astronomy Observatory (NOAO); the International Dark-Sky Association (IDA), Centro de Apoyo a la Didactica de la Astronomia (CADIAS), Environmental Systems Research Institute, Inc. (ESRI) and GLOBE.

Attached on the next page is the template for Crux.

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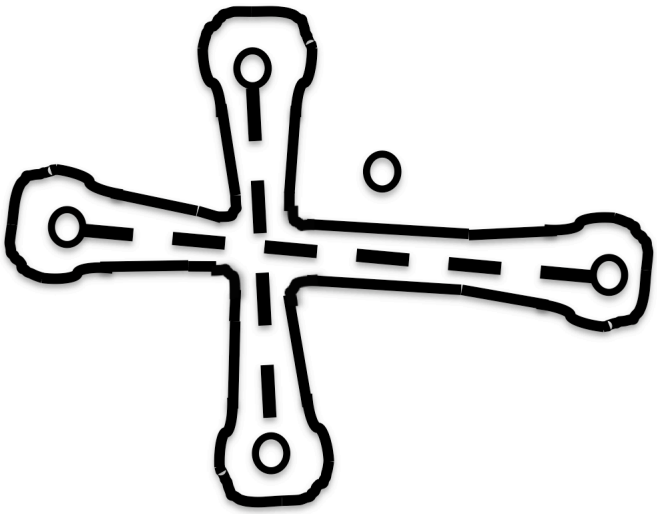
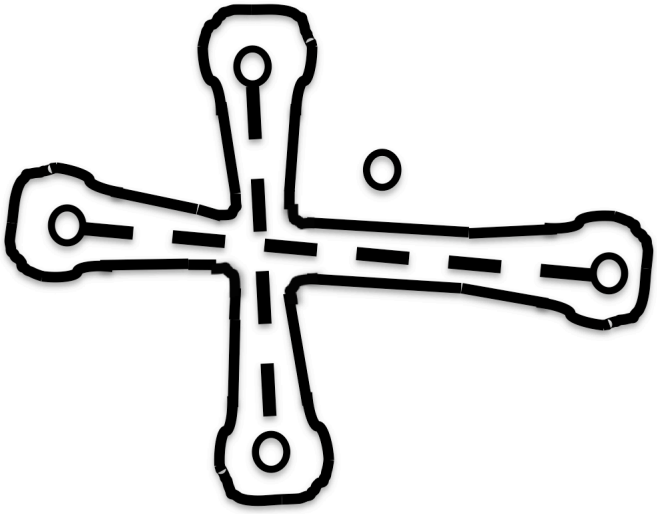


Crux (the Cross)



Crux (the Cross)