

Accessible Adaptations for The Big Astronomy Toolkit

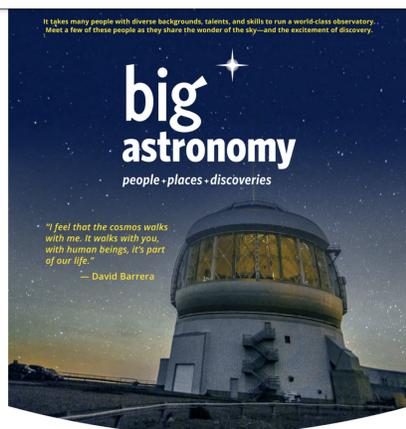
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Introduction

Big Astronomy: People, Places, Discoveries is a multifaceted research and outreach project supported by several partners and funded by the National Science Foundation. Big Astronomy delivers a unique learning experience for planetarium visitors around the world by integrating virtual interactions with those living and working at Chilean observatories with curricular resources and a planetarium show. The Big Astronomy homepage (bigastronomy.org) includes information on live webinars, the planetarium show, research and informal educational materials. The Big Astronomy Toolkit and the Manual for Accessible Adaptations are accessed in the Education drop-down menu and includes activities from the Night Sky Network.

I was brought into the Big Astronomy project as a consultant to create accessible experiences for educators and students using the Big Astronomy Informal Education Toolkit. In this presentation, I am going to showcase examples of the adaptations I developed that make the toolkit activities more accessible, equitable and inclusive to learners who are blind or visually impaired.

When you download the Big Astronomy Toolkit from the Big Astronomy homepage (bigastronomy.org), you will access a series of informal activities that include: Visualize our Galaxy, Clues to the Cosmos, Good Night-Good Light, Dark Sky Wheel and Legends in the Sky. The Manual for Accessible Adaptations for these activities includes instructional pages to create the modifications for these activities with step-by-step instructions and a supply list of inexpensive materials needed to create accessible versions of the activities. Here are some of the modified activities.



Outreach Toolkit Table of Contents

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Copies for educational purposes encouraged.
Manual and more: bit.ly/bigastro

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Figure 1: Big Astronomy Toolkit

Visualize our Galaxy

The first activity is called Visualize our Galaxy. The front side of the instructional page for this activity shows an image of the Milky Way band, illuminated over an observatory. On the reverse side of the page are the “Notes for the Presenter.” It is recommended that you either obtain an umbrella with an artistic representation of the Milky Way, or download a flat version of the same artistic representation of the Milky Way galaxy with the link provided (<https://nightsky.jpl.nasa.gov/docs/UmbrellaMilkyWayFinalApr29.pdf>) to “print your own poster.” The artistic image of the Milky Way includes a small circle on a spiral arm that represents the stars visible to the unaided eye from Earth. The dot in the center of the circle represents the location of our solar system.

One way to make this image accessible non-visually is to print out an 11” x 17” copy of the image and laminate it. Use glitter fabric paint to outline the spiral arms of the Milky Way and smooth fabric paint to fill in the central bar of our galaxy. You must wait 24 hours for the fabric paint to dry before touching it! The glitter fabric paint will dry to a rough texture. Cut out a round smooth foam sticker the same size as the circle and overlay the foam sticker onto the circle. Finally insert a very small brass fastener in the center of the foam circle to identify the location of our solar system.

A second way to create a tactile image of the galaxy that does not require a 24-hour waiting period is to trace the galaxy with thin copy paper and cut it out to use as a template. Trace the template onto a piece of (rough) glitter foam adhesive paper. Cut out the Milky Way glitter foam galaxy, peel back the adhesive paper and attach the galaxy to a piece of smooth black felt. Trace the central bar of the Milky Way on copy paper, and use it as a template to make a central bar with a smooth piece of foam sticker. Peel back the adhesive paper and place the smooth foam central bar on top of the glitter foam galaxy. Cut out a circle using the same type of smooth foam sticker and attach it to the spiral arm in the same location, as it would appear on the artistic version. Finally, insert a very small brass fastener in the center of the circular foam sticker to indicate the location of our solar system. You now have a glitter foam model of the Milky Way Galaxy with rough and smooth textures.

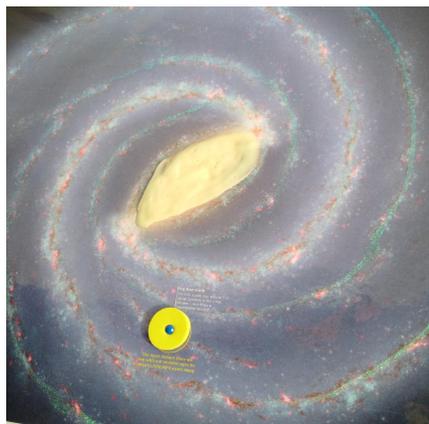


Figure 2: Tactile Models of Milky Way Galaxy

Clues to the Cosmos

The activity entitled Clues to the Cosmos teaches students how astronomers can make discoveries by observing the same object through different wavelengths. The instructional page for this activity includes a picture of Supernova 1987A as seen in radio waves (from ALMA), visible (from the Hubble Space Telescope) and X-ray (from the Chandra X-ray observatory) plus a larger (composite) multi-wavelength view of these three wavelengths. For this activity, you will need cotton sewing batting for the radio view, beads strung like a bracelet for the visible view, and rubber shelf liner for the x-ray view.

Print out the image (<https://hubblesite.org/contents/media/images/2017/08/3988-Image.html?news=true>) of Supernova 1987A to 11" x 17" and laminate it. Cut out two pieces of the same cotton batting (one size to fit the small ALMA view and one size to fit the composite view). String two bracelets of beads, making one bracelet the size of the small Hubble view and one size to fit the larger composite view. Cut out two pieces of rubber shelf liner where one is the small Chandra image size and the other matches the size of the composite view. Discuss with students how different telescopes can detect different wavelengths. Have participants place the soft batting on the ALMA image to represent radio emission, the small beaded bracelet over Hubble to represent visible emission and the rubbery donut-shape shelf liner over Chandra to represent x-ray emission. Ask visitors how **they** might make a multi-wavelength tactile view of Supernova 1987A using the remaining materials.

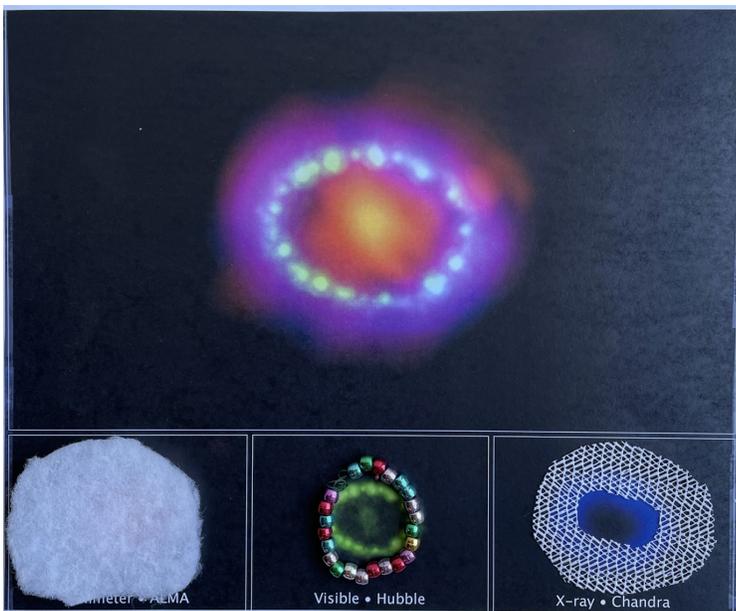


Figure 3: Supernova 1987A Tactile Activity

Dark Sky Wheel

The Big Astronomy Toolkit includes a template to print a Dark Sky Wheel. Unlike a typical star patterned planisphere, the Dark Sky Wheel relates light pollution to the visibility of stars. There are two star wheels: one for Scorpius and one for Orion. Both star wheels are divided, like pieces of a pie, into six wedges. Each wedge reveals the same constellation but with differing amounts of visible stars due to light pollution. Users will learn that very light polluted skies reveal few stars while darker skies with little light pollution reveal the most stars.

The Dark Sky Wheel **Cover** is connected to the inner star wheel with a brass fastener. The cover identifies the constellation and has an opening cut out. So, when the wheel is rotated, a wedge shaped section of the inner printed star wheel is revealed. By rotating the wheel and reviewing the changes in star visibility, visitors can understand that **more light pollution means fewer stars can be seen**, and that **less light pollution means the sky is dark on a clear night and more stars can be seen**. It's like looking at a few visible stars from a bright city sky and comparing it to seeing thousands of stars from a mountaintop.

To make this activity more accessible for visitors with low vision, make large print copies (11" x 17") of the **Dark Sky Wheel Cover** and **inner Dark Sky Wheel circle**, and **laminates them to make them sturdy**. To make light pollution more accessible non-visually, we will combine the idea behind the Dark Sky Wheel with the Legends in the Sky activity to connect the idea of star visibility and light pollution.

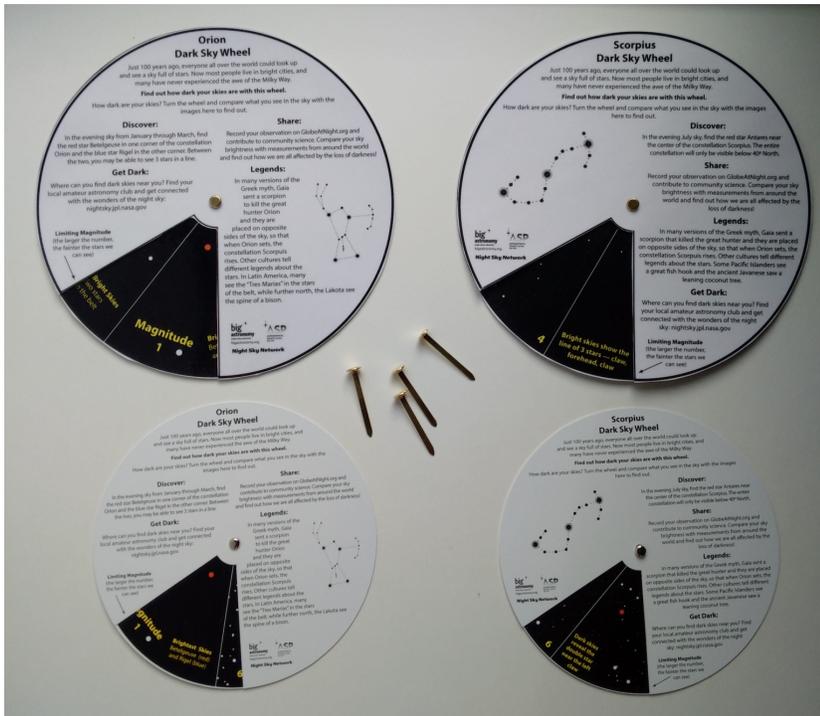


Figure 4: Enlarged versions of Dark Sky Wheel

Legends in the Sky (Create your own Constellation and Constellation Cards)

The Legends in the Sky activity can be done in multiple ways. When using the “Create Your Own Constellation” activity, visitors create their own constellations by connecting the dots using the provided templates (<https://nightsky.jpl.nasa.gov/docs/LegendsCardsToPrint.pdf>). These pages show the stars as black dots on a white background. To make this activity more accessible for visitors with low vision, make large print copies (11” x 17”) of these templates.

A different strategy to make the constellations accessible by touch is to print out the “constellation black cards” from the Legends in the Sky activity on card stock paper (<https://nightsky.jpl.nasa.gov/docs/LegendsConstellationsBlackCards.pdf>). Each card should be about 4” x 6”. For this activity, you will need three different size brass fasteners with different head sizes: standard, small and very small. You can find these on Amazon (https://www.amazon.com/WXJ13-Fasteners-Office-Supplies-Making/dp/B077461RH9/ref=sr_1_2?crd=35JLDCSRVT63W&keywords=paper+fasteners+of+different+head+sizes&qid=1651462290&prefix=paper+fasteners+of+different+head+sizes%2Caps%2C68&sr=8-2)

Insert the very small brass fasteners into the faintest stars, the standard (largest) brass fasteners into the brightest stars and the small brass fasteners into the remaining stars. Use scissors to trim the corners of the completed legend cards so they will easily fit into the resealable sandwich bags. Place the cards into bags and invite people to **touch the stars!**

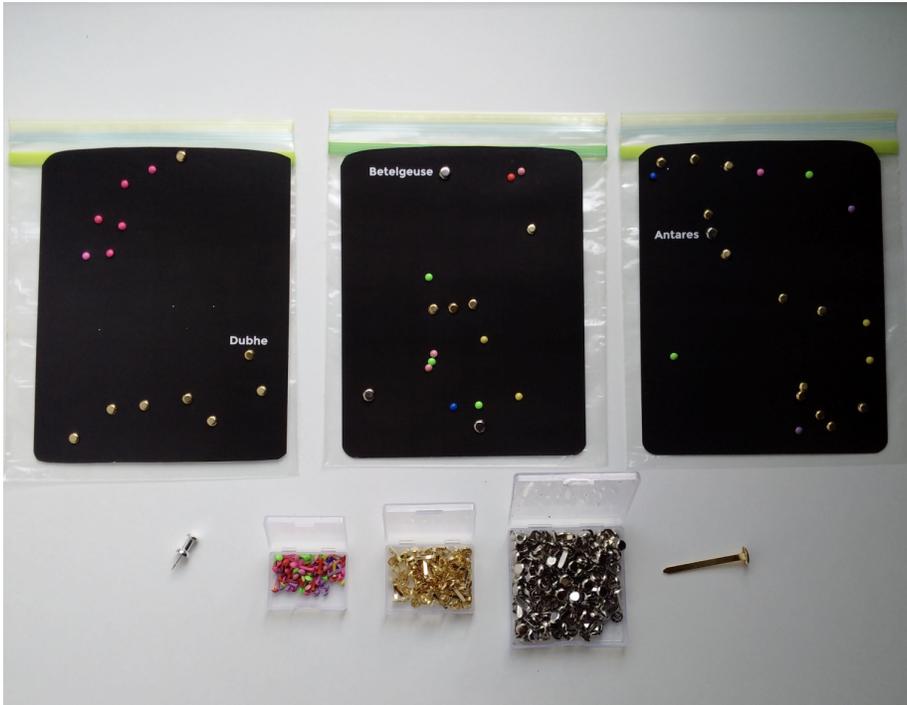


Figure 5: Tactile Constellation Cards (with brass fasteners)

Extension – Combine Tactile Constellation Cards with a light pollution simulation

Recall that the Dark Sky Wheel activity visually relates the amount of light pollution to the ability to see stars of different magnitudes. We can create a tactile light pollution activity using the tactile star cards. You will need 5-6 pieces (4" x 6" each) of sewing batting of different thicknesses (available at your local sewing store), 5-6 resealable sandwich bags and a pair of scissors.

Cut one 4 x 6 inch sample of each of the batting material, and place each sample into a resealable bag. That is, place a thin piece of batting in one bag, then place a thicker piece of batting in another bag and so on. The bags will serve as light pollution simulators. Once you have all 5-6 samples in their own bags, invite visitors to **first feel the tactile star cards in their bags (with no light pollution); then place each light pollution simulation bag, one at a time, over each star pattern.** Ask visitors to arrange the sewing batting in order by low light pollution to heavy light pollution and compare the amount of stars that are detectable.

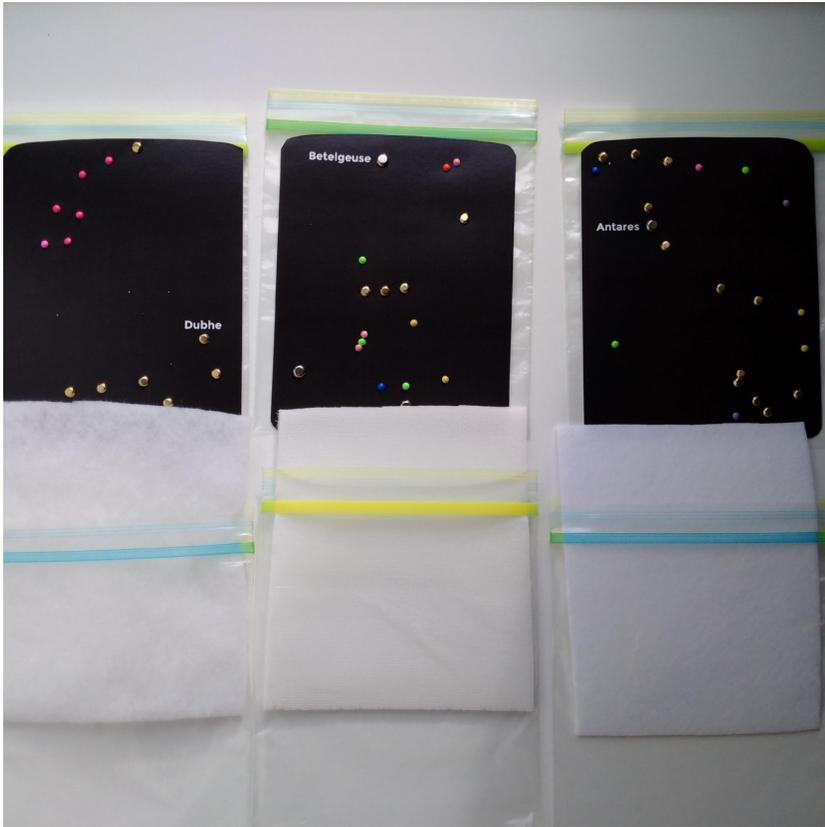


Figure 6: Tactile Constellation Cards with sewing batting to simulate light pollution

Panel Discussion: Accessibility in Astronomy Outreach

Featuring Noreen Grice, Ken Quinn, and Vivian White
September 29, 4 PM Chile Time / 3 PM EDT

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To learn more about accessibility options for Big Astronomy and Astronomy Outreach, review the “Accessibility in Astronomy Outreach” webinar (originally presented on Sept. 29, 2021), which is archived at <https://www.youtube.com/watch?v=oppivG2EuIM> and also linked on the Big Astronomy homepage (bigastronomy.org).



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