THE RISING STARGIRLS

TEACHING AND ACTIVITY HANDBOOK

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www.risingstargirls.org

RISING STARGIRLS

Stars shine in many colors.

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Thank you for your interest in Rising Stargirls activities!

Rising Stargirls is committed to the idea that **there is no one way to be a scientist**.

By integrating creative strategies such as free writing, visual art, and theater exercises, we have created a new, innovative astronomy curriculum that addresses each girl as a whole by providing an avenue for individual self-expression and personal exploration that is interwoven with scientific engagement and discovery.

Many of these activities come from other programs, and are reprinted here with permission from those programs. Others were created by us. You can use whichever activities are most useful to you, depending on the time available, size of the group of girls that you are working with, and the individual interests of the group. They are created for middle-school girls, ages 10-15. If you use them with high-school age girls, you may want to adjust some of the activities accordingly.

Enjoy!

Dr. Aomawa Shields
Founder and Director, Rising Stargirls (www.risingstargirls.org)

About the Founder

Photo: Martin Cox

Dr. Aomawa Shields received her PhD in Astronomy and Astrobiology from the University of Washington in 2014. She also received an MFA in Acting from UCLA in 2001, and a Bachelor's degree in Earth, Atmospheric, and Planetary Sciences from MIT in 1997.

Dr. Shields is currently an NSF Astronomy and Astrophysics Postdoctoral Fellow, a UC President's Postdoctoral Program Fellow, and a 2015 TED Fellow at the University of California, Los Angeles, and the Harvard-Smithsonian Center for Astrophysics. She studies the climate and habitability of planets orbiting stars other than our Sun, called extrasolar planets. The 2016 recipient of the Origins Project Postdoctoral Award Lectureship, Dr. Shields will be an Assistant Professor in the Department of Physics and Astronomy at the University of California at Irvine beginning in Fall 2017.

Dr. Shields is the founder of Rising Stargirls, an organization dedicated to encouraging girls of all colors and backgrounds to explore and discover the universe using theater, writing, and visual art. She uses her theater and writing background to communicate science to the public in engaging, innovative ways.

A Letter to the Educator

Dear Educator,

Thank you for willingness to explore creative and interactive ways of engaging girls in astronomy and astrobiology! I hope you find these activities fresh and exciting. Make them your own, and incorporate them into your classrooms, after-school programs, and informal learning environments as best fits your schedule and the particular needs of the girls you serve.

It is crucial that you establish from the very first activity a set of principles to adhere to throughout the implementation of all Rising Stargirls activities. These principles include:

Respect—between the girls and their peers. Laugh in support of your fellow girl, not to separate or isolate.

Inquire. There are no stupid questions. The more we ask, the more we learn! So Ask!

Stand tall and proud of our diverse backgrounds and experiences.

Encourage each girl to explore and understand the universe in her own way and in her own time. She can understand as much as she wants to. It's only a question of time, willingness, and effort.

The acronym for these principles is **RISE**. Display it and the principles for which it stands somewhere in your activity meeting place. It is not only an acronym, but a fervent wish and prayer that these activities will help to nurture a seed of wonder about the universe and all that it holds for these magnificent girls, excitement about what more there is to discover and learn, personal awareness, truth, self-acceptance, and confidence in their own abilities and potential for success.

If you feel that your astronomy background is not as strong as you would like it to be to implement these activities, do not worry. There are many resources provided here. Additionally, there may be an astronomy ambassador near you to contact for support, or who could answer some of your girls' questions over email.
Visit this list of astronomy ambassadors here:
http://aas.org/outreach/roster-aas-astronomy-ambassadors

Most importantly, please listen to your girls. Assess and adjust the activities according to the signals and responses you receive from them throughout the time you are together. Listening is powerful. The girls will tell you where they want to go.

Have fun!! And bring snacks for the girls! You'll be glad you did.

Dr. Aomawa Shields, Founder and Director, Rising Stargirls

GRATITUDE

Special thanks to Mary Dussault in the Science Education Department at the Harvard-Smithsonian Center for Astrophysics for reading an early draft of this handbook, and for crucial mentorship and support throughout its creation.

Thank you to the National Science Foundation, for its support of the work that led to Rising Stargirls, and for its continued support of both my research and educational endeavors. Thank you also to the NASA Astrobiology Institute, for in-kind support.

Thank you to the TED Fellows program, for the opportunity to share the mission of Rising Stargirls with educators and girls across the globe. Thank you as well to my assistant Kelly Hwang, for her incredible help with Rising Stargirls.

Thank you to my mother, who always called me her "star girl".

Thank you to my father, for encouraging the vision of Rising Stargirls from the beginning.

Thank you to my husband, for being born, for being my fiercest supporter, and for helping me continue to rise.

Thank you to the girls at Irving STEAM Magnet Middle School and Science Club for Girls, for showing me what worked, what didn't, and how to listen.

This handbook is dedicated to all girls of different colors, young and old, who have looked up at the stars and wondered what was out there. May we all continue to question, continue to learn, and let absolutely nothing hold us back.

The "star girl" at age 7

DAY 1

On the first day of any new program or activity, it is a good idea to do exercises which help the girls get to know each other. It is especially important to give the girls the opportunity to express themselves and their personality from the beginning.

Theater exercises are a great way to start. Here are some good ones:

Learning Goal: Get girls up on their feet, moving, out of their heads, and into their bodies.

1. Pass the ball of energy (5-10 min)
   Girls stand in a circle. The leader starts, by holding an imaginary ball of energy in front of them. She passes the ball of energy, along with a sound that is evoked by holding the ball, to the girl next to her. The girl receives the ball of energy, and lets it change and transform in her hands into whatever feels natural. She uses both body and voice to receive, and then pass along the ball of energy. Each girl in turn does the same, until the ball of energy has made it around the entire circle. This continues as long as the group likes. Tell the girls to use their whole body, not just their hands, and to let the sound come from their entire body, not just from their throat.

2. Zip Zap Zop (http://www.utexas.edu/cofa/dbi/node/29) (10-min)
   Reprinted here with permission from the Drama-Based Instruction (DBI) Network
   Procedure:
   Everyone stands in a circle. Ask the group to repeat the words "Zip, Zap, Zop" three or four times, all together. Tell them you have a bolt of energy in your hands. To start the game, send the bolt out of your hands with a strong forward motion straight to someone else in the circle (using your hands, body, eyes, and voice) saying "Zip." Be sure you make eye contact with the person you pass it to. They should receive it with their whole body and pass it immediately to someone else saying, "Zap." That person passes it on with a "Zop." The game continues "Zip, Zap, Zop." If there is a mistake, encourage students to simply resume playing without discussion. Challenge students to NOT make the game about them by using funny voices or taking a long time to choose the next person.

   Possible Side-coaching:
   > "Don't forget to make eye contact with the person you pass the bolt of energy to."
   > "Work to stay focused. There should be no pauses. The bolt of energy should never hit the ground."

Variations and Extensions:

-Once a group has gotten very good at this game (usually this means playing it three or four times) explain that you will begin the game in the usual way but at some point you will start moving around the playing space. When this happens, everyone must move around the playing space, yet keep the game going. After a few minutes, return to your space in the circle. At this point everyone must return to her spaces, too. The game should continue seamlessly throughout all of the action.

-"Zip Zap Boing"
At any time in playing, participants can "boing" a zip, a zap, or a zop. To do this, they raise both hands in front of their bodies, at chest height, and say "boing," so the move bounces back to whoever passed it. Then whoever initially passed the zip, zap, or zop passes it to another person. So it might sound like "zip-zap-boing-zap-zop-zip-boing-zip", etc.

Processing Points:
Describe: What did you notice during this game?
Relate: What could we do to play even more effectively?

3. "What are you doing?" game (10 min)

Everyone forms a long line at one end of the room. The first player of the line steps forward and starts miming an activity. As soon as the activity is clear, player 2 approaches player 1 and asks "What are you doing?"

The first player answers something that has nothing to do with what she`s actually doing. For example, if player 1 is pretending to roller skate, when asked what she's doing she might say "I'm reading a book".

The first player moves away, and the second player starts miming the activity stated by the previous player. A third player comes up to player 2, asks what she is doing, and so on.

Play until everyone has mimed something, and has answered the question.

Other theater games can be found here: http://improvencyclopedia.org/

Activity: Who, what, and where?

Learning Goals: Encourage personal expression and stretch of imagination; provide an opportunity for girls to get to know each other through personal sharing.

Once the girls are warmed up from playing a couple of theater games, have them all sit in a circle.

Pass around an object (could be one of the "Celestial Buddies" from "Introduction to the Planets" activity on Day 4).

Have each girl say:

a. Her name
b. A favorite hobby
c. Where she would visit on Earth or elsewhere in the universe if money were no object

Each successive girl must first repeat the 3 facts about the girl before her, followed by her own. The last girl must repeat everyone else's before hers. This encourages girls to volunteer first. It means they have less to remember! It also gets girls to listen to each other share, and learn about each other.

First exploration of how girls view scientists (15 min)

Distribute lined composition books to girls, along with a pen. Each girl gets her own. These will be called "playbooks" to encourage girls to think of the activities they do inside the books as play, NOT work.

1. Pass out pencils, colored pencils, crayons
2. Have girls draw what a scientist looks like (Do not give girls any leading or prompting beforehand. Just tell them to draw what they think a scientist looks like).
3. When all girls have finished, ask girls to share adjectives aloud that came to mind when they were doing their drawing.

Decorating "playbooks" at Irving STEAM Magnet Middle School, Eagle Rock, CA, 2015

Writing exercise #1 (15-20 min):

Goal: Initial assessment of girls' exposure to astronomy/astrobiology concepts.

Tell girls the rules (Inspired by *Writing Down the Bones*, by Natalie Goldberg.):

1. Keep hand moving for full 5 min
2. Don't cross out
3. If you get stuck, write the first sentence again: "When I look at the sky at night I think of…I think of….I think of…"
4. You might think of other things not related to the sky during the writing time. That's great! Write it down. It's a starting point, but our minds don't always stay in a straight line (they rarely do). Follow your mind where it goes.
5. If you feel like you're dancing around something that you really want to say, write a dash --- what I really want to say is_____.

Writing Prompts:

1. Girls open playbooks/journals and write for 5 min "When I look up at the sky during the day I think of…"
2. Girls write for 5 min "When I look up at the sky at night, I think of…"
3. Girls turn to the girl to their right and take turns reading what they wrote.

Writing exercise #2 (10 min)

1. Free writing topic: "When I hear the word "Astronomy", I think of…" (5 min)

2. Free writing topic: "When I hear the word "Astrobiology", I think of…" (5 min). Say, "If you don't know what Astrobiology is, put that down. That's why you're here!"

3. *Assessment question: Yes/No response: Girls record in their books if they have ever gone outside at night and looked at the stars, either while camping or stargazing by themselves. ("Write: Been outside and looked up at night sky: (Yes/No)"

4. Divide girls into groups of 3. Girls take turns reading their writing to each other.

5. Come together as a group. Invite girls to share aloud some of their thoughts on both words.

Writing exercise #3 (10 min) **– ASSESSMENT Q's**

Have girls open to a new page in their playbooks, and say: "On scale of 1 (strongly disagree) to 6 (strongly agree) rate your level of agreement for the following statements":

1. I talk to my family and friends about science.
2. I see myself as a science person.
3. I believe I can do well in science.
4. I like my science classes.
5. Rate your interest in astronomy
   1 to 7 (note the different scale here)
   1 = "Not interested at all"; 7 = "I want to be an astronomer"

6. Rate your current knowledge of Astronomy
   1 to 7
   1 = "I don't know anything"; 7 = "I'm an expert"

[Hint: it helps if you write each sentence on the board, with the numbers underneath. For example:

I talk to my family and friends about science.

1 6
strongly disagree strongly agree

and tell the girls they can choose any number from 1 to 6 to rate their level of agreement with this statement.]

Who/where/how/what: Introducing yourself to the girls (20 min)

This is an important component the workshop, especially if the girls are just meeting you for the first time today. Tell them about yourself – who you are, where and who you came from (place and family), how you got here (whatever that means to you), and what nourishes/fuels/supports you in your daily life and endeavors. The girls are going to do this exercise too, so be as open as you can be, as it will help them feel comfortable sharing who they are in a personal way.

I encourage you to use PowerPoint slides showing pictures of you as a young person (like these girls are), your family, favorite places in the world, astronomical images that signify what got you interested in astronomy, etc. Be creative. And be brave. Share your struggles with them, and any other personal challenges, especially if related to academics. And share outside hobbies! This will help the girls start to see that scientists (and other professionals) are regular, three-dimensional people like them.

Activity: Decorating Playbooks (1-1.5 hrs)

Learning Goal: Allow the girls time to personalize their playbooks with astronomy pictures they select themselves, along with providing initial exposure to pictures of astronomical phenomena.

Tools:
Playbooks
Astronomy magazines (Sky and Telescope, Astronomy, Scientific American, National Geographic):
Scissors
Glue sticks

1. Spread magazines on the floor in the center of the room.
2. Tell girls to flip through magazines and tear out pages with pictures they like.
3. Girls decorate front and back cover of their playbooks.

Option: You could bring in other magazines as well – maybe travel magazines, home decorating magazines – to give the girls an opportunity for even more personal expression in their playbooks. Be careful with bringing in fashion magazines though, as some of the content in those magazines is adult in nature. If you do decide to bring in fashion magazines, be sure to tear out pages that have mature content in advance (or just bring in age-appropriate pages from the magazines).

Note: Be sure to tell the girls to write their names in the inside cover of the playbook, so you know whose is whose.

"Playbook" covers designed by girls in Science Club for Girls, Cambridge, MA, 2015

Hint: It's nice to play some instrumental music while the girls do this. This time also gives the girls a chance to talk and get to know each other.

At the end of the day, collect each girl's playbook. Tell them you will keep them safe, and that they don't have to worry about forgetting to bring them the next session, and you can have a chance to read their writing responses for your own assessment purposes (evaluating as you go).

Homework: Tell the girls it is now their turn to do Who/Where/How/What. They can use laptops if they have them, and put pictures on PPT slides. Or if they do not have laptops, they can bring in pictures and pass them around. They should answer all four questions (Who are you? Where and who do you come from (place and family)? How did you get here (whatever that means to you)? What nourishes/fuels/supports you in your daily life and endeavors? Tell the girls to aim for 10 minutes, and if they can, to practice at least once before (tell them to practice in front of their family if possible).

END OF DAY 1

DAY 2

When all the girls have arrived, have them get up on their feet and do a quick game of Zip Zap Zop (see Day 1)

Activity: Who/Where/How/What (30-45 min)

Learning Goal: Give the girls the opportunity to share who they are with their peers, and enhance their self-esteem through personal expression and communication.

Each girl shares their personal story in whatever way she chooses best. Be sure to tell all the girls at the beginning to listen and pay attention to each other, and to give the same respect to their peers as they would want to have themselves.

Constellation activity (30 min)

Learning Goal: Introduce the girls to what constellations are, to their subjective nature, and to the range of cultures that have named constellations and created myths around their origin.

Educator: Say something like, "So I heard [or saw in their writing in their playbooks] the word "stars" mentioned earlier this week. Any particular pattern stars can take?" (Wait for someone to mention "Constellations").

1. Have girls write down in their playbooks the names of any constellations they've heard of, and whether they've seen them directly (1-2 min).

2. Discussion: Girls share the names of the constellations they wrote down. **Note:** You will likely hear "big [little] dipper!" This is fine. If you like, you can tell them that technically these are patterns within the larger constellations of Ursa Major and Minor, respectively.

3. Pass out books/charts for the most popular constellations—Ursa Major/Minor , Orion, Cassiopeia, Pegasus, etc. Examples of books that are good to bring in are:

   Constellations: A Field Guide to the Night Sky, by Giles Sparrow
   Stars: A Month-by-Month Tour of the Constellations, by Mike Lynch

4. Show map of US with state boundaries. Then show Celestial map with constellation boundaries (these are in the above books, or a large celestial map poster is great).

5. Up on feet: in groups of 6-7, each group chooses a constellation and assembles themselves into a shape with the brightest stars in the constellation (Note: If group is small, have one or two girls come up to draw on easel/white board)

6. Facilitator asks: "If you are the constellation, then what direction is the Earth so it sees the pattern you make as the stars? " [answer: ceiling looking down or floor looking up]

7. *Assessment Question: "Everyone close their eyes. Raise your hand if you think that the stars we see in a constellation are all at the same distance from the Earth? And how many think that the stars in a constellation are at different distances from the Earth?" **Answer:** Different distances. The stars in a given constellation are not actually physically associated with each other.

8. Tell the girls the answer: "Actually, the stars in a constellation just look to us like they're all at the same distance from us. In reality, they're all at difference distances, and are not even physically related to each other. For example [show the constellation of Orion in one of the books, or draw it on the board. Many girls are familiar with this constellation.] the star Alnilam in Orion is almost 6x farther away from us than Bellatrix. This pattern of stars looks a certain way to us because of where our planet is in Space. To someone on another planet somewhere else in he universe, they might see an entirely different pattern of stars.

A few things about stars…

Educator: Tell the girls, **"**I want to cover something important about stars. Stars come in many colors. There are yellow stars, like our Sun, and blue stars, and red stars too (*if you have a large blue ball, a medium-sized yellow ball, and a small red ball, this is good to use while you're explaining*). There are also orange and white stars too. Blue stars are really big, yellow stars are mid-sized, and red stars are really small. Most of the stars in our galaxy are small, red stars. Planets have been found orbiting all colors and sizes of stars."

"Anybody know why stars shine? They shine because they're working hard. They're like big factories, converting a chemical called hydrogen into another, heavier chemical called helium (like the helium in balloons at b-day parties!). That process releases energy, and that energy makes the star shine. Stars shine in many colors. Stars are like you. You are all shining brightly here on Earth, and you shine in many colors."

"Stars also are born, live, and die, just like us. Anybody run track? Or have you ever had friends who ran around a lot and were always busy, going here and there, doing this and that? Is that you? If so, do you have friends who seem to move slowly – walk slowly, talk slowly, and take longer to eat? Stars are different like that too. The big

ones are the sprinters, giving everything they've got for a really short amount of time, and then they're done, and they die. The small ones are the long distance runners, conserving their energy so they can last the whole race. Big, blue stars don't live very long, a few million years (not that long for stars), and small, red stars live for billions or trillions of years!"

Activity: Make Your Own Constellation (45 min)
Developed by Professor Kelsey Johnson for the organization "Dark Skies, Bright Kids" at the University of Virginia (dsbk@virginia.edu). *Reprinted here with permission from Kelsey Johnson.*

Description

Students are given an introduction to some constellations in the night sky and are taught some of the constellation creation myths. Students create their own constellation and write their own story that explains the creation of the constellation. Students share their constellations and their stories with the class.

Materials

- Educator
  - A single-hole punch
  - Ability to show constellations in the classroom, either using planetarium software or prepared images
  - Black construction paper (cut each 8.5x11-inch paper in half)
- Each student needs
  - Constellation template
  - Dry erase crayons or chalk

Goals

- Demonstrate that constellations are cultural constructions
- Create a new constellation and its origin story
- Share their work with their peers

Introduction to Topic

Constellations are patterns of stars in the night sky that resemble objects, people, or animals. Different societies have created their own constellations in the night sky. In the United States, we are most familiar with the constellations of the Greco-Roman tradition, but nearly every culture has their own constellations and a set of corresponding myths that explain the origin of that constellation. We present some references for constellation stories in the Resources section. There are several ways to teach this lesson depending on your goals. Some examples are:

Pro Tips

- Make sure to mention that many constellations are pictures drawn *around* the stars. Encourage your students to be creative!

1) Encourage students to observe the night sky; present a set of constellations and stories that are visible in your area for the current time of year.
2) Demonstrate that constellations are cultural a phenomenon; present constellations that are represented in multiple cultures. Some constellations that appear in both Greco-Roman and Native American mythology are Orion, Taurus, Ursa Major, and Ursa Minor
3) Write original stories;
   Present a set of constellations that tell a complex story.
   a. Andromeda, Pegasus, Perseus, Cepheus, Cassiopeia, and Cetus are related in Greco-Roman mythology.
   b. Ursa Major, Ursa Minor, Canis Major, Canis Minor, and Orion are related in both Native American and Greco-Roman cultures.

Pre-Activity Instruction

Explain what constellations are and how constellations are created. Ask students if they know any constellations and/or their origin myths.

Preparation

1) Pick at least two constellations to show students and learn their associated origin myths. Some excellent books for this are:

   Dot to Dot in the Sky: Stories of the Stars, by Joan Marie Galat

   Dot to Dot in the Sky: Stories of the Zodiac, by Joan Marie Galat

   Sharing the Skies: Navajo Astronomy, by Nancy C. Maryboy, PhD and David Begay, PhD

   Stars of the First People: Native American Star Myths and Constellations, by Dorcas S. Miller

2) Punch holes in the construction paper (we find that half-sheets work well) randomly to serve as stars.

3) Gather materials.

Procedure

1) Show the constellations to the students. Do they "see" the picture in the stars?
2) Give the students each a piece of construction paper. Tell them to pretend that the holes in the paper are stars and to use them to create their own constellation.
3) Have the students name their constellation and write their own origin myth.
4) Have the students share their story with the class.

Post-Activity Discussion

- *Can anyone create constellations?*
  Yes! And they can share their constellation story with their friends and family.
- *Summarize what constellations are and encourage the students to go out one dark night to see if they can find anything up in the night sky. They might even be able to find their own constellation!*

Extensions and Related Activities

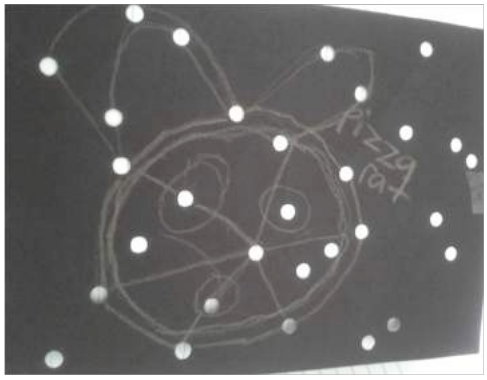
- Observing

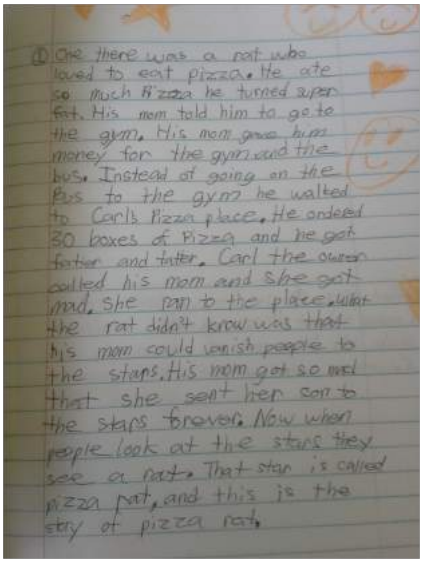
Resources

- Dot to Dot in the Sky is a series of books that show common solar system objects and gives their related creation stories at an appropriate level for elementary school classrooms.
  http://www.whitecap.ca/Detail/1552851826 (sky)
  http://www.whitecap.ca/Detail/1552858057 (zodiac)
- Several astro-photographers offer series of real night sky images that show common constellations as they appear to the naked eye or with amateur telescopes.
  http://southernskyphoto.com/constellations/constellations.htm
  Note: These are often "upside-down" compared to how girls in the Northern Hemisphere would typically see them. Be sure to mention that, especially if you are working with girls in the Northern Hemisphere!
- *Stars of the First People* is an excellent book that compiles a number of myths from Native American peoples.
- *Sharing the Skies* is a book about Navajo Astronomy.
- Ian Ridpath is a professional astronomer who has created an online book that gives a detailed history of constellations and their related mythology. See especially chapter 3.
  http://ianridpath.com/startales/contents.htm
- Stellarium is free, open-source planetarium software that can be used on most personal computers and operating systems. It contains overlays of constellations from many cultures and contains links to their origin myths.
  http://www.stellarium.org/

Glossary

- *Constellation* – A group of stars perceived as a figure or design, most notably those from classical mythology, common animals, and objects.
- *Myth* – A traditional story, especially one concerning the early history of a people, the world, or a natural phenomenon.
- *Origin Story* – A story that explains how something came to be.




Once there was a rat who loved to eat pizza. He ate so much pizza he turned super fat. His mom told him to go to the gym. His mom gave him money for the gym and the bus. Instead of going on the bus to the gym he walked to Carls Pizza place. He ordered 30 boxes of Pizza and he got fatter and fatter. Carl the owner called his mom and she got mad. She ran to the place. What the rat didn't know was that his mom could vanish people to the stars. His mom got so mad that she sent her son to the stars forever. Now when people look at the stars they see a rat. That star is called pizza rat, and this is the story of pizza rat.

***Top**: Girls at Irvine STEAM Magnet Middle School take part in "Make Your Own Constellation" Activity during Rising Stargirls workshop in March, 2015. **Bottom**: The constellation "Pizza Rat" and accompanying origin myth developed by one of the girls at Irving.*

END OF DAY 2

DAY 3

Activity: Art and the Cosmic Connection
(http://discovery.nasa.gov/art/index.cfml) (1.5-2 hrs)
Created by Monica & Tyler Aiello, Artists & Educators for NASA's Discovery and New Frontiers Programs

Credit: NASA's Discovery and New Frontiers Programs (http://discovery.nasa.gov/) and Eurekus (http://www.eurekus.org/).

Art & the Cosmic Connection is designed to engage students in space science education by becoming artist explorers. Using the elements of art – line, color, texture, shape, and value – students learn to analyze the mysterious surfaces of our rocky celestial neighbors - planets, moons, comets and asteroids – as well as our beautiful Earth.

Goals: Fusing art and science education inspires students to explore both disciplines. Students create art inspired by planetary images, and their understanding of planet surfaces deepens when observing them through an artist's lens.

For the Educator:
- Educator Guide (discovery.nasa.gov/art/pdfs/Art_CosmicConnection_EdGuide.pdf)
- PowerPoint Presentation (discovery.nasa.gov/art/pdfs/Art_CosmicConnection_slides_notes_Final.pptx)
- Presentation Notes (discovery.nasa.gov/art/pdfs/Art_CosmicConnection_slides_Notes.pptx)
- NASA Space and Earth Images (discovery.nasa.gov/art/pdfs/Space_Earth_Images.pdf

Tools for the girls:
-NASA Space and Earth images (see above)
[Print out two copies of the space images and put them in sheet protectors (so each side shows the same image)]
-Soft pastels
-Large (at least 9"x11") drawing paper
-Hand wipes
-Fixative spray
-Q-tips
-Gummy erasers

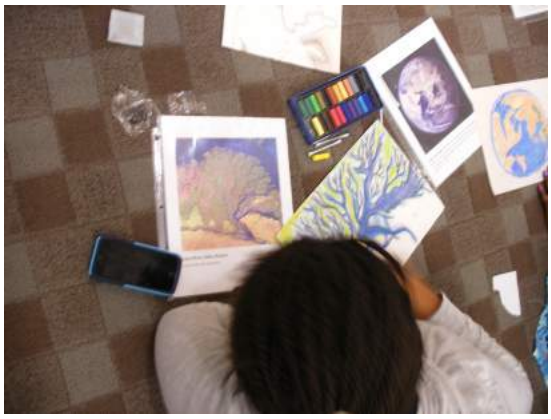
Go through the PPT presentation, introducing the girls to the elements of art and how they manifest in planetary surface geology. The beginning of the PPT provides

an excellent intro to the planets in general, and you can involve the girls by asking them to name the planets before you tell them, etc.

Then spread out the NASA space and earth images (I keep them in sheet protectors in a binder), and have the girls each select an image and do her own artistic interpretation of the image. Be sure to tell them their drawing does NOT have to look exactly like the image. That's why it's an interpretation!

Later, you can spray their images with the fixative. It's a good idea to spray them outside, or in a well-ventilated area.

If time permits at the end of the day, go around the room and have each girl share why they chose their particular NASA image, and what aspects (if any) of the image they focused on while making their artistic interpretation.




Girls participating in "Art and the Cosmic Connection" during Rising Stargirls workshop, July, 2015

END OF DAY 3

DAY 4

Activity: Introduction to the planets (1-1.5 hrs)

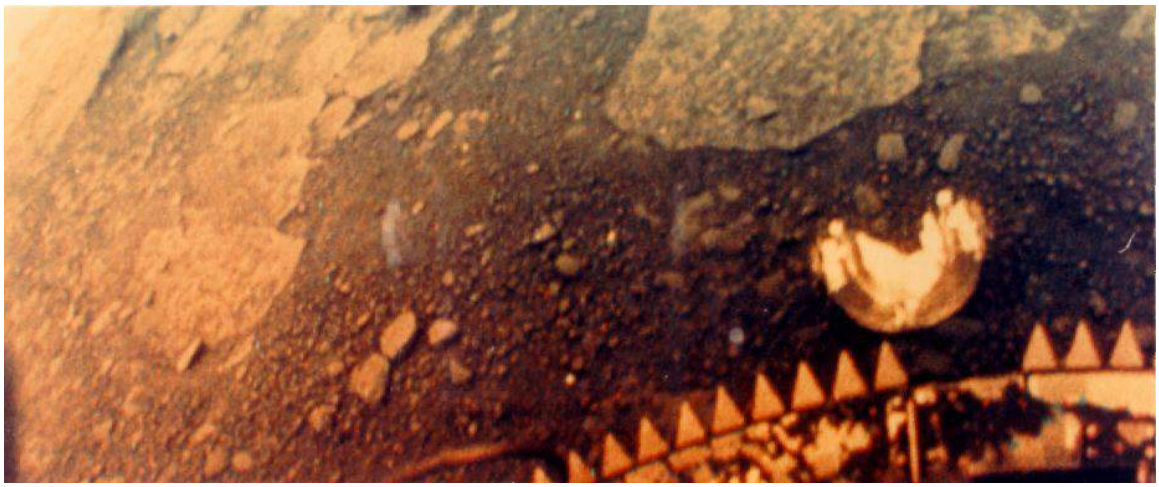
Learning Goals: Introduce girls to the different planets that make up our Solar System, and basic aspects about each planet; encourage girls to listen to their first instincts, and to begin to accept their creative minds and how they could be connected to what they learn about astronomy; encourage the girls to think about the significance of a planet's atmosphere; give the girls a basic understanding of scale, and the distances between the inner vs. outer planets.

Planets

- Lay out plush planetary pals (See photo. May be purchased from www.celestialbuddies.com. Or you can show slide images of different planets.)
- Also can print out this set of solar system lithographs (with picture on front and information on the back, and even laminate them) and pass them around as you discuss each solar system body: https://www.nasa.gov/audience/foreducators/topnav/materials/listbytype/Our_Solar_System_Lithograph_Set.html
- Go through each planet
  - Ask girls "what do you notice about each planet?"
  - Then show actual image of planet in PowerPoint (images of Solar system planets can be found here: http://spaceplace.nasa.gov/gallery-solar-system/en/) **Note**: You may have already shown some of the terrestrial planets in "Art and the Cosmic Connection".
  - Tell girls to write down in their notebooks the first word that comes to mind when they see the planet.
  - Say, "What do you notice about the Earth here? Anything (colors, oceans, continents)?[girls answer out loud]
  - Talk about the Earth. Ask "What makes it different from other planets in the solar system? (has oceans, life, blue sky, etc.,)
  - Pass around the Earth planetary pal (if you have it)
  - Pass around Ritz crackers. "Write down the first thing that comes into your mind when you look at or touch or taste the cracker. This doesn't have to make sense. It can be totally random, and that's fine. Wonderful even. "
  - Ask, "Is there anything about the crackers that reminds you of some aspect of the Earth?" (Ask girls to volunteer to share if something comes to mind.)
  - Show Venus (picture and Buddy). Write down the first word that comes into your head when you see it. "What have you heard about Venus? Where does it get its name? What does it

mean? Close your eyes! Is Venus a hot or cold place? Raise your hand if you think it's cold. Raise your hand if you think it's hot."

- Talk about Venus ("it could melt lead!" "You couldn't breathe", etc.)
- Pass around something warm (a rock warmed in the sun, a hot water bottle, a big fuzzy sweater)
- "Venus is really hot. Does anyone know why?" (They might say because it's so close to the Sun. Give ample time for any other answers.)
- "Venus is closer to the Sun than Earth, but it's much hotter than it would be based on that distance. It's so hot (almost 900 degrees F (almost 500 C)!) because it has a REALLY thick atmosphere."
- Talk about how an atmosphere is like a thick sweater. Ask the girls "Has anyone ever gone outside when it's really hot, and worn something much to warm, like a big sweater or coat? What does that feel like?" (Let girls answer.)
- "Well that's how Venus is. It's wearing a really heavy coat. And that's what makes it so hot."
- "Have humans ever set foot on Venus? [Answer: No.]
- Show Venera lander image (see below): http://nssdc.gsfc.nasa.gov/image/planetary/venus/venera13-left.jpg



Surface photograph from the Soviet Venera 13 spacecraft.

- Go through each planet, and the Sun, like this. You could also talk about comets and asteroids too. Be sure to mention when you get to Mars that Mars actually has an atmosphere that's too thin ("So it's wearing a light, wispy tank top, when it should have on a jacket!"). You can also say, "Because its atmosphere is so thin, its temperatures are all over the place, from pretty

warm to REALLY cold. An atmosphere helps keep the temperatures on the surface of a planet from getting too hot or too cold. This is why the Earth has a climate that's pretty pleasant for the most part."

- Discuss the order of the planets from the Sun.

- Go over planet order – Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune

- Discuss why Pluto is no longer a planet
  - Can find two good summaries here: http://www.nasa.gov/audience/forstudents/k-4/stories/nasa-knows/what-is-pluto-k4.html

    http://www.universetoday.com/13573/why-pluto-is-no-longer-a-planet/

- Talk about where else in the Solar System life might exist (generally, we'll get into this in more detail later)
  (Hint: Moons of Jupiter (Europa), and Saturn (Enceladus))

- 1: 10 billion scale "Walk" *(inspired by this activity: https://**solarsystem**.nasa.gov/docs/**voyages**calemodelss.pdf)*
  - Let each girl (or 2-3 girls) choose a planet (or the Sun/moon). If you don't have the plush planetary pals, you can print out images of the planets and laminate them.
  - Take the girls outside to a big lawn or other open space.
  - Girls will walk the distance between the planets (and Neptune to Pluto) in the solar system, shrinking the distance by 10 billion.

Sun to Mercury	6 paces
Mercury to Venus	5 paces
Venus to Earth	4 paces
Earth to Mars	8 paces
Mars to Jupiter	55 paces
Jupiter to Saturn	65 paces
Saturn to Uranus	144 paces
Uranus to Neptune	163 paces
Neptune to Pluto	142 paces

Left: Celestial Buddies plush planetary pals used in Solar System scale walk.
Right: Girls standing doing Solar System scale walk, Cambridge, MA, 2015.

Ask the girls: "What do you notice about the spacing between the inner vs. outer planets?"
Answer: They are much more closely spaced than the outer planets.

Ask the girls: " On this 1:10 billion scale, how far away do you think you would have to walk to get to the nearest star? "
Answer: The length of the entire United States. [If you are on the East Coast of the US, you could say, "California!", or say, "New York!" if you're on the West Coast.] This will usually garner lots of "Ooohs" and "Ahs". [**Note:** If you and the girls are in/on a different country/continent, pick a familiar region of similar distance.]

Activity: Make your own planet mnemonic (20 min)

Learning Goal: Get girls to develop their own creative way to remember the order of the planets in the solar system.

Have girls work in groups of 2-3 to create a mnemonic to remember the order of the planets. Have them write them in their playbooks.

Example:

My **V**ery **E**ducated **M**other **J**ust **S**houted **U**phill **N**icely

After 15-20 min, have girls share aloud the mnemonics they came up with.

Activity: Name That Planet (~30 min)

Learning goals: Encourage girls to absorb what they have learned so far about different solar system planets through having to communicate that information to their peers using creative methods; encourage the girls to explore different modes of communication – visual, verbal, and kinesthetic.

1. Divide girls into two teams. Have each team come up with a name for themselves that is related to one of the planets (ex. Miracle Martians, Neighbors of Neptune, etc.)

Put up on board:
Mercury – Mercurians
Venus – Venusians
Earth –Earthlings
Mars – Martians
Jupiter – Jovians
Saturn – Saturnians
Uranus – Uranians
Neptune – Neptunians

Part 1.
2. Member from each team comes to stand in front next to an easel.
3. Give them each the name of a planet.
4. Member draws clues on the easel to get their teammates to guess the name of the planet without writing the name of the planet or any other words. First team to guess gets one point. [**Note:** Encourage girls to only guess from the clues they see in the drawings, not to just call out a list of planets until they hit the right one.]

Part 2.
1. New team members comes to easel.
2. Gets name of new planet
3. Member has to get team to guess using words (no drawing), but can't say name of planet (of course)

Part 3.
1. New team members comes to easel.
2. Gets name of planet.
3. Now they can't draw or speak, but must "act" out the planet in some way.

Part 4 (Optional):
1. Two members (can be from opposite teams, or the same team) come up

2. Both get the name of a planet together. But they can't talk to each other. They go behind a screen or just outside of the room with you with them, and they get 30 seconds to come up with a strategy to get the group to guess the name (they must communicate to each other non-verbally). Then they come back in and act it out.

END OF DAY 4

DAY 5

Activity: Distance calculation (~1.5 hrs)

Learning Goal: To get the girls to understand the distance to the planets using a unit of measurement that is personal to them – themselves!

Tools:

-Poster board
-Markers, crayons, pencils
-2-3 tape measures
-Calculators
-Chalkboard or easel with paper (or large pad of paper)

1. Say, "Yesterday we talked about the planets in our own Solar system, and even walked the distances between the planets after shrinking the distance down by 10 billion. What are some of the things you learned about the distances between the planets?" (**Possible answers**: distances between inner planets are smaller than distances between outer planets; Inner planets are rocky, outer planets have a lot of gas in their atmospheres; The nearest star is REALLY far away. The distances between the planets don't even compare.)

2. Today we're going to calculate the distances between the Sun and the different planets in the solar system, in units of YOU!

3. Divide the girls into groups of 3-4. Tell each group to measure the length of each girl in the group (have her lie down on the floor and extend the tape measure from the top of her head to her feet). Have the girls record the length/height of each girl in feet in their notebook.

4. Go around the room and have each group go up to the board/easel and write down each girl's length next to their name (let them know that if they would prefer not to have their name next to their heights in public, that is ok. They can just have the information for themselves).

4. Help the girls convert feet and inches to feet only. Ex. 5 ft., 5 inches ~ 5.4 ft.
5. Have pieces of paper up on the wall (or on PPT slides projected on a screen nearby) with the distance from the Sun to different planets in miles and ft.

   Example: The distance from the Sun to Venus is: 67.24 million miles
   1 mile = 5,280 ft.

   67 million miles X 5,280 ft./mile = 354 BILLION ft.

6. Make sure the girls know how many zeros come after the 1 in 1 billion (Answer: 9). Then have the girls pull names of Solar System planets out of a hat to do their distance calculation. (Other option – let girls choose their favorite planet to do their distance calculation and poster)

7. Help the girls calculate the distance to their chosen planets in units of themselves. (Ex. Sara = 5.4 ft. The distance from the Sun to Venus is 354 billion ft./ 5.4 ft. = 66 billion Saras!)

8. Once girls all have calculated their distances, pass out a poster board to each girl, and put pencils, crayons, and markers out. Have them draw their planet (you can put up PPT slides of the different planets or the plush planetary pals too), and the sentence "The distance from the Sun to _____ is (example) 66 billion Saras." They can draw themselves if they want, and decorate the posters however they want.

   Note: You may also (or instead of) choose to calculate the distance from Earth to different planets, as shown below.

Amahirany displaying her poster showing the distance from the Earth to Saturn in units of Amahiranys, Irving STEAM Magnet Middle School, March 2015.

END OF DAY 5

DAY 6
Introduction to Extrasolar Planets

Learning Goal: Introduce the girls to the concept of there being planets outside of our Solar System, orbiting stars other than the Sun; deepen an understanding of scale, and of the distance to these planets.

-Start by reminding the girls about the previous day's activities (learning about the different surface geology of planets, moons, and asteroids in our own solar system, and then walking the distance between the Sun and the planets in the Solar System on scale shrinking the distances down by a factor of 10 billion.

-Make sure they understand that the real distances between the planets in the Solar System are 10 billion times farther than the distances they walked!

-Remind the girls that the nearest star to the Sun would be across the country if we shrunk its distance down by 10 billion.

-Ask: "Now who has heard of the word "extrasolar planets" or "exoplanets"? Can anyone tell me what those are?
Answer: They are planets orbiting stars other than our Sun. So they are planets orbiting in their very own solar (stellar) systems.

-Given that we talked about how far away the nearest star to us is, and exoplanets orbit their very own stars, what does that tell you about the distances to exoplanets?
Answer: They are REALLY far away!

-Ask: "Why do you think we're interested in looking for planets orbiting other stars? What interests you about the search for other planets?" (some girls might mention the search for life on another planet, but there could be multiple answers, which is great!).

Show this webpage on the projector screen: http://planetquest.jpl.nasa.gov/

Say, "This is a webpage where a lot of information about extrasolar planets is kept. It shows that we have been finding exoplanets for the last 20 years!"

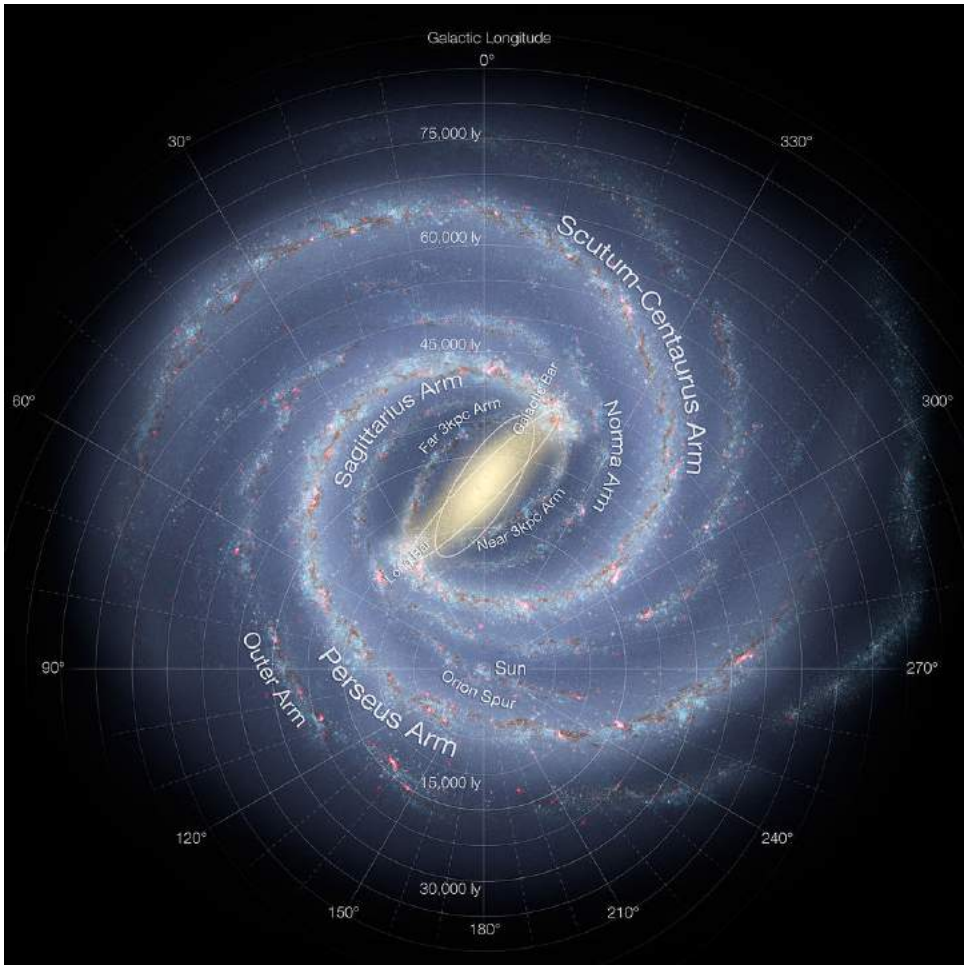
"How many does it say we've discovered so far?"

"And how many of those discoveries are confirmed (meaning they are definitely planets)?"

We know of almost 2000 planets outside of our eight solar system planets! That's a lot! And all of these planets are in our own galaxy. What is the name of our galaxy?
Answer: The Milky Way.

-Show a picture of the Milky Way. You can find one here:

https://en.wikipedia.org/wiki/Milky_Way#/media/File:Artist%27s_impression_of_the_Milky_Way_%28updated_-_annotated%29.jpg



Artist's conception of the spiral structure of the Milky Way with two major stellar arms and a bar. Credit: NASA/JPL-Caltech/ESO/R. Hurt

-Say something like, "Now this is actually a diagram of the Milky Way, not an actual image. We don't actually have a real photo of the entire Milky Way looking down on it from above. Why do you think that is?"

(This is a tough question. If no one answers, you can give them a hint; "Which galaxy are we in again?" **Answer:** The Milky Way. "The Milky Way! Right! So since we're inside of this galaxy, we wouldn't be able to take a picture of it from outside of it, unless we were able to travel to another galaxy and take a picture. And our spacecraft aren't yet able to travel that far!"

"Has anyone ever seen a part of the Milky Way before? Where did you see it?"

(Some girls may say in the desert, or out camping. But no one may have been somewhere with dark enough skies to see it. You can show them a slide from here: http://www.nps.gov/grca/learn/nature/night-skies.htm

The Milky Way over Grand Canyon National Park as seen from the South Rim. Wotan's Throne and Vishnu Temple are seen in the distance. Credit: Tyler Nordgren, University of Redlands

Another great one is here: https://www.washingtonpost.com/news/in-sight/wp/2015/06/12/majestic-views-of-stars-and-sand-along-egypts-white-desert/

The Milky Way is seen in the night sky around telescopes and camps of people over rocks in the White Desert north of the Farafra Oasis southwest of Cairo, May 16, 2015. Credit: Amr Abdallah Dalsh/Reuters

And here's a view from the International Space Station!:
http://www.nasa.gov/content/milky-way-viewed-from-the-international-space-station

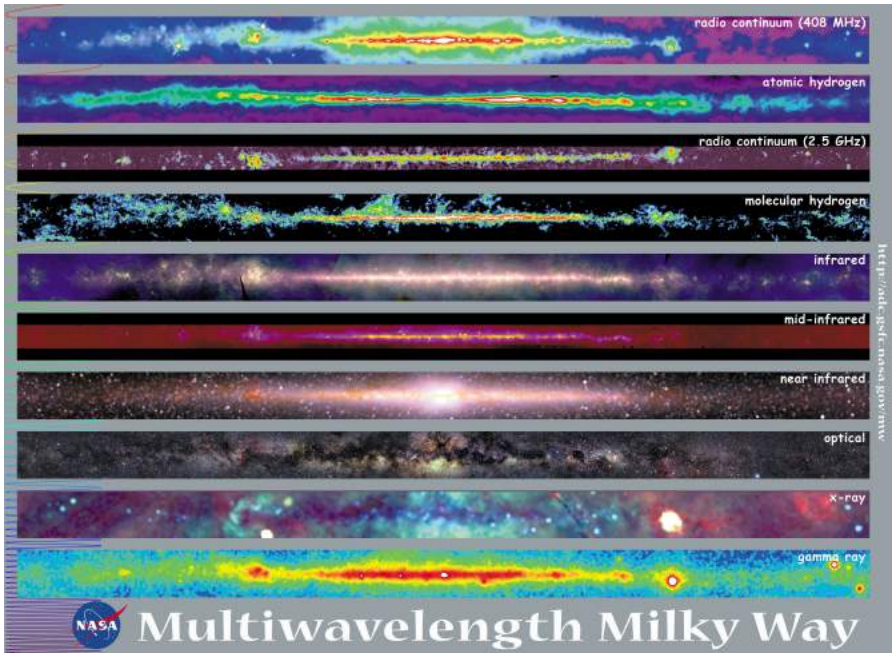
Credit: NASA/Reid Wiseman

Say, "This view is looking through the disk of the Milky Way, right towards the center of the Galaxy. We are actually located in one of the galaxy's spiral arms, in the disk. And those dark patches? It might look like there's nothing there, but there actually is."

"We're looking at the Milky in visible light here—the type of light we see with our own eyes. But there are other types of light besides visible light. There's ultraviolet light (UV), which comes through our atmosphere, which is why we have to wear sunblock, because it can be harmful. There's also infrared light.

"Let's look at the Milky Way in different types of light:"

Show this image here:
http://mwmw.gsfc.nasa.gov/mmw_product.html#slides



Credit: NASA

You could also print this out poster-sized and bring it in.

You may also like to show (time permitting) the (~30-min long) video there about seeing the Milky Way in different types of light.

Say, "Astronomers can look at all sorts of objects in the universe in these different types of light—galaxies, stars, clouds of gas called nebulae, and planets too! And doing that helps them understand what's going on inside and around these objects much more fully than if they just looked at them in one way."

Say, "So as you can see, there is so much more to the universe than what we can see with our eyes, just like there's SO much more to each of you girls than meets the eye. You each have different feelings and thoughts about yourself and the world that no one can see from the outside. But they're inside you, and they're important."

[You may want to leave some time here for girls to share any thoughts or feelings that come up here.]

Option: You might also want to show the Earth in different ways. For instance, show the Earth at night, where the girls can see how much more populated certain parts of the planet are than others. There is a cool video here: https://www.nasa.gov/mission_pages/NPP/news/earth-at-night.html#.VvMeWSnfhc4].

Say "There are 100 billion galaxies in the universe, so a LOT more than just our own. And we think there are millions more planets that we haven't even found yet in our own galaxy alone. So what does that mean for the total number of planets that might exist in the universe?" **Answer**: There are a LOT!!

You can also talk about how we have found these planets, using predominantly two methods:

The Doppler Wobble (use a hula hoop to show how the Star (you inside the hula hoop) wobbles as something goes around it (the hula hoop, signifying the planet in its orbit). We can measure how much the Star wobbles, and that tells us just about how massive the planet is.

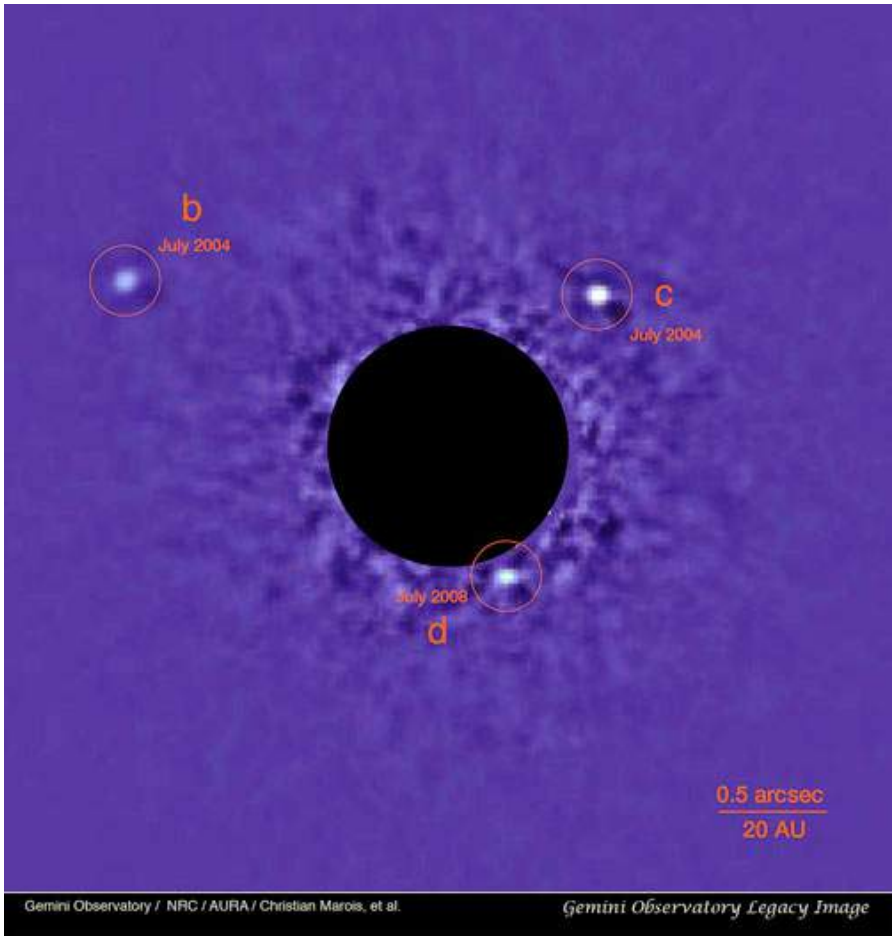
Transits (you can use a flashlight, and have one of the girls bring a pen or a match stick in front of the flashlight bulb from the vantage point of the girls sitting in the audience. We can measure the dip in the light caused when the pen/match stick (the planet) crosses in front of the flashlight bulb (the star), and that tells us how large the planet is.)

Artist impressions of exoplanets

Educator: Say, "Another way we can find planets is to take pictures of them. Is anyone in the room a photographer? Typically when you take a picture of something, you're not very far away from it, so the picture comes out pretty good. Have you ever taken a picture of something far away? What does the picture look like? (Maybe one of the girls says "fuzzy" or "blurry")

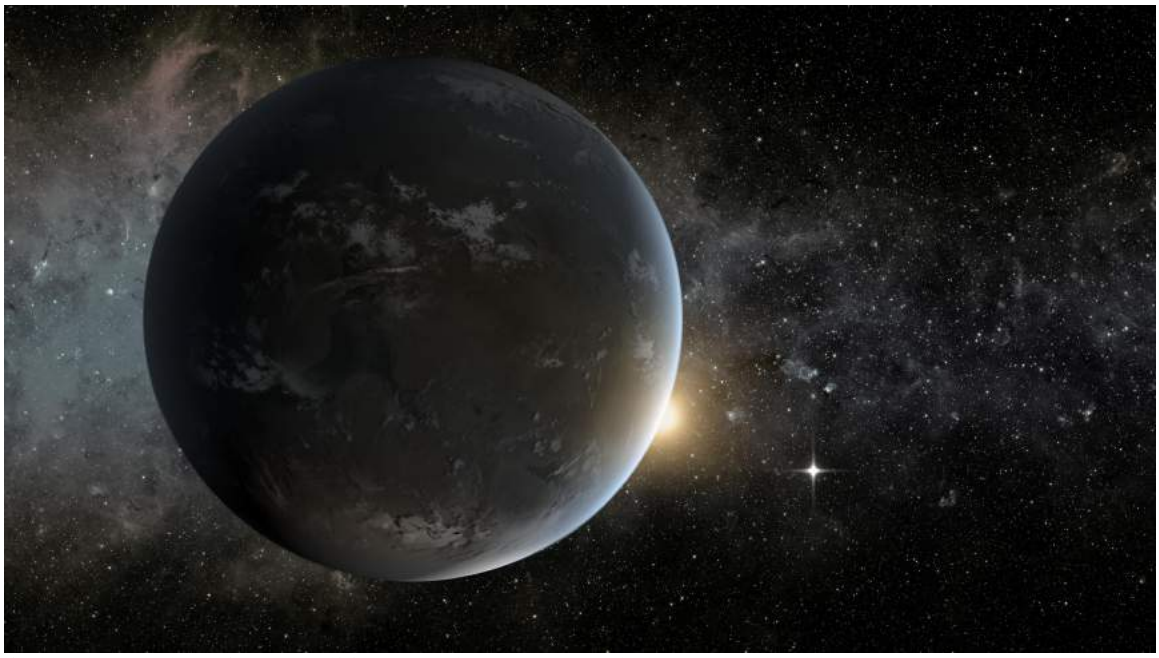
"Well, it's the same for taking pictures of exoplanets, except they are REALLY far away from us. So we only have VERY blurry images of exoplanets, and only the very biggest ones. Those images look like this":

http://blogs.discovermagazine.com/badastronomy/2008/11/13/huge-exoplanet-news-items-pictures/#.VrPpQ1JOHn4



Educator: "The big black circle is where we used a shade to block out the light from the much brighter star. The planets that orbit this star are just fuzzy blobs. The only really detailed images we have are not real pictures at all, but artist impressions of what the planet might be like. Like these":

http://www.space.com/23805-alien-super-earth-planets-discovery.html



Artist's impression of Kepler-62f, a potential super-Earth in its star's habitable zone.
Credit: NASA/Ames/JPL-Caltech

Or this one, of the possible landscape on an exoplanet:

https://commons.wikimedia.org/wiki/File:An_exoplanet_seen_from_its_moon_%28artist's_impression%29.jpg

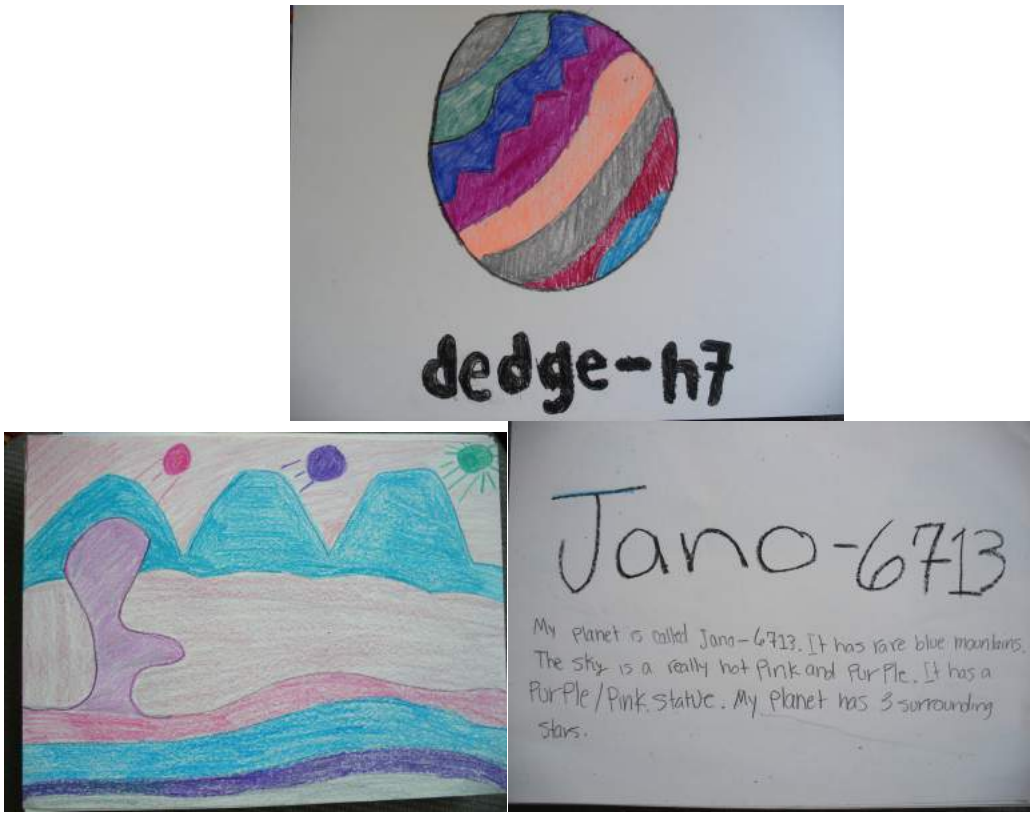
Educator: So now I want YOU to be the artist, and draw your own artistic impression of an exoplanet!

Activity: Design your own exoplanet (1.5 hrs)

Learning Goal: Provide an opportunity for the girls to think creatively and critically about the types of exoplanets that may exist, what planets might look like and why, and what elements of a planet might be conducive to life or detrimental to life.

1. Give each girl a large sheet of construction paper or poster board, and put out pencils, markers, crayons, and colored pencils.
2. Have each girl design their own exoplanet

    a. Things to think about:
        i. Is the planet a rocky world like Earth, or a gas giant like Jupiter?
        ii. Is it cold or hot?
        iii. If it's rocky, does it have oceans and land? Just land? Just oceans? Does it have mountains?
        iv. How many stars does the planet orbit? One, two, or three? Four?
        v. Does the planet have life on it? What does that life look like? How does it breathe? If the planet doesn't have life, why not?
        vi. What is the name of the planet (you get to make it up!)



Exoplanets designed by girls at Irving STEAM Magnet Middle School during Rising Stargirls workshop, March 2015

END OF DAY 6

DAY 7

Activity: Which is bigger? (30 min)

Learning Goal: Deepen an understanding of astronomical scale with the girls, using objects familiar to them as a jumping off point.

Educator: "So now that we've talked about planets and stars and exoplanets, and a little about galaxies, we're going to do an exercise. But before we do that one, let's do another one:"

Have girls all stand up, and ask girls to arrange themselves in order of shortest to tallest.

Next, ask girls to stretch their arms out to their sides (like in the shape of an airplane), and ask the girls to arrange themselves in order of smallest wingspan to largest wingspan.

Note: If you have labels "smallest" and "largest" and "shortest" and "tallest" that you can give to the girls to keep themselves oriented, that would be helpful.

Educator: Ok, I am going to bring out a bunch of objects, and I want you to put them in order of smallest to largest in terms of size.

Educator brings out the following objects in actual, physical form:

A yo-yo
A penny
A mug
A Celestial buddy (one of the plush planetary pals from "Intro to Planets" activity
A large bag
One of the girls in the room (ask for a volunteer)

Educator: Ok, now I'm going to show you pictures of a bunch of objects, and I want you to put them in order of smallest to largest.

Educator presents the girls with slides (or printed pictures) of the following objects (you can take these pictures yourself if you can't find them online):

A mug with someone's hand around the handle
A penny
A car with someone in front of it
The ocean
The Earth
The continent of Africa

A middle-school girl of color (try to find a picture of girl who is African-American, Hispanic, Native American, or Hawaiian/Pacific Islander to foster connection).

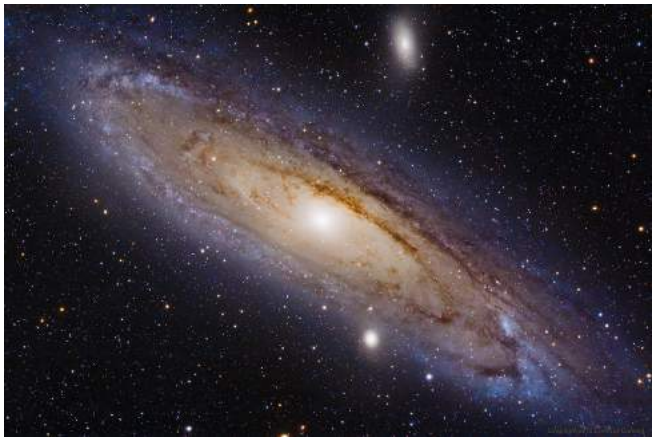
When the girls are finished putting the pictures in order of smallest to largest, invite them to share reflections on this exercise (some might mention how it's more difficult to do this exercise when you don't have the objects there themselves).

Educator: "Ok, now we're going to arrange something else in order of smallest to largest. Look at these pictures, and put them in the order of smallest to biggest."

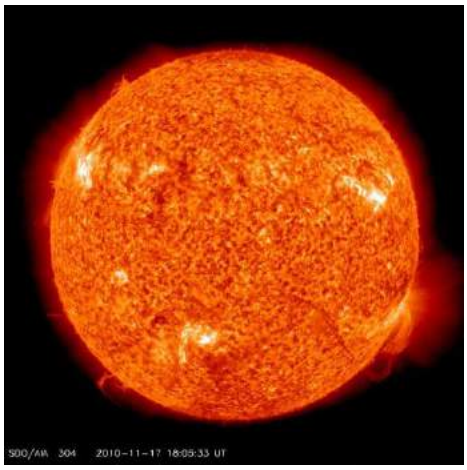
Educator shows the following pictures on a slide projector, or brings printed photos to show. Afterwards, again invite the girls to share their reflections.

Saturn - Credit: NASA

Earth's Moon - Credit: all-geo.org



Andromeda Galaxy – Credit: Lorenzo Comolli



The Sun – Credit: NASA

Earth, from Apollo 17 – Credit: NASA

Activity: Create and perform your own poem (~ 1-1.5 hrs)

Learning goals: To encourage girls to think about what they've learned about astronomy and astrobiology in the context of their own lives, and to continue exploring different forms of creative expression.

1. Read poems aloud written by boys and girls of similar age to your girls. If the poems have an astronomy theme (subject is the Sun, moon, stars, universe, etc.) this is especially good.

   Examples: *Turning into Stars: California Poets in the Schools Statewide Anthology 2012 (*see excerpts further down); *My Mouth the Galaxy: California Poets in the Schools Statewide Anthology 2015.* These can be copied and distributed to the girls to read aloud. Ask for a volunteer to read each poem. Full publications can also be purchased here: http://www.cpits.org/anth.html.

2. Ask girls "How could parts of this poem be expressed using the body?" (hint: have girls choose words that stood out to them in the poem, and then encourage them to stand up and use their bodies to depict that word)

3. Have girls choose an astronomical object (other than the Earth) to put into their poems. Could be the Sun, a planet, a galaxy, Moon, stars, an asteroid, etc.

4. Tell the girls they are to write their own astronomically-themed poem.

5. Important to tell the girls the rules:
   a. Poem must include: At least one astronomical object, an object or memory from their daily lives (notebook, toothbrush, day at the park, family dinner, cell phone, iPod, walking in the woods, on the bus, eating a PB&J sandwich), and a color of their choice.
   b. Poems do NOT have to rhyme.
   c. Poems do NOT have to make logical sense. But they do need to be deliberate (make a choice, don't just throw words together randomly).
   d. Write the poem down in their playbook.

6. Girls divide into teams of 3-4, Have the girls each read their poems aloud to the group. Then the group as a whole decides which poem would lend itself well to acting out. The girl whose poem is chosen becomes The Director. The other girls are The Actors. The director then helps the other girls "act" out her poem.

7. Each girl in the group must choose at least one body movement or expression to use in the performance of the poem (in the spirit of "Show, don't tell).

8. Girls are given ~30 min to practice the poem.

9. Each group performs their poem for the other group. (Try to film this if you can).

10. After all groups have performed, ask the girls to share their experiences writing a poem and developing a poem into a performance piece.

END OF DAY 7

SAMPLE POEMS TO READ ALOUD IN THE GROUP

(from *Turning into Stars: California Poets in the Schools Statewide Anthology 2012, and My Mouth the Galaxy: California Poets in the Schools Statewide Anthology 2015, reprinted with permission from California Poets in the Schools*)

The Sun

The sun is on the move
jumping and skipping across the sky.
He hears music,
the music of the wind,
blowing about like cool jazz,
the music of the birds,
first soft, like a crooning,
then loud, bubbling out its throat,
the music of the sun itself, glowing out of a mouth
of nonexistence, filling the day
with light, making people around the world laugh.

Ocean Ortiz
Fifth Grade, Springhill School, Contra Costa County
Deborah Hungerford, classroom teacher
J. Ruth Gendler, poet-teacher

The Night's Secrets

The night is like a leaping leopard,
jumping from star to star.
It comes to meet me twice a year
but never succeeds. One day it will.
It flies like a bird, smooth as a snake
determined to meet me.
Its special power is to appear
as nothing and change back to itself.
It tells me secrets about
all the stars from the past.

Andrew Eliason
Third Grade, Spreckels Elementary, San Diego County
Betty Nova, classroom teacher
Celia Sigmon, poet-teacher

(both poems from *Turning into Stars: California Poets in the Schools Statewide Anthology 2012, reprinted with permission from California Poets in the Schools*)

Dark Says

I am blackness.
I bring the moon and the stars
I give you nighttime to help you sleep
I don't need these little wings
I need to wait for my turn
The mountain of darkness is on my nose
My eyes are light but a spot of darkness
remains in my left eye
I am longer in the winter and shorter
in the summer
I hide under the table and come out at night
I am the shadows
I don't own the sun
I am most of space
I am important to earth
Together, me and light steady the temperature
To find me you have to stay up
I am the oldest thing but I am
still young

Cobi Napili
Fourth Grade, Lakeshore Elementary School, San Francisco
Michael McCauslin, classroom teacher
Grace Grafton, poet-teacher

(from *Turning into Stars: California Poets in the Schools Statewide Anthology 2012, reprinted with permission from California Poets in the Schools*)

I Am the World

I am a huge, strong planet. I wonder
if I am the largest thing around.

I hear men and women talking about planets.
I see nothing but a glow from far away.

I want to see down inside of myself.
I am the world.

I feel sad that I can't know
what it is like to be a person.

I say to you, "I will never die,
but this rotation is boring me."

I dream of doing something exciting.
Someday I hope to become famous.

Be kind to me. I am the world.

Trent Johnson
Third Grade, Spreckels Elementary School, San Diego County
Marisela Sparks, classroom teacher
Seretta Martin, poet-teacher

(from *Turning into Stars: California Poets in the Schools Statewide Anthology 2012, reprinted with permission from California Poets in the Schools*)

My Imagination

I am lost in the scenery of imagination,
the view of mountains,
the beautiful freshening smell of the ocean of jasmines.
I gaze at the dolphin of the moon,
how could it be so bright?

What if our world turned into a feeling?
The joy of peace enlightens me,
the courage and passion make me brave,
but the sorrow of anger scares me.

I step out of my imagination…
everything is gone…
I am left alone
all
by
my
self

Preeti Tamhankar
Sixth grade, Pomeroy Elementary, Santa Clara County
Sandra Armstrong, classroom teacher
Mara Sheade, poet-teacher

(from *Turning into Stars: California Poets in the Schools Statewide Anthology 2012, reprinted with permission from California Poets in the Schools*)

Not Mexican Enough

"But you can't be Mexican," they say,
eyes narrowed accusingly,
brows knit in frustration.
"But I am Mexican, if only a quarter."
I don't look Mexican at all, with long fair hair, blue eyes,
and whiteout skin.
I am a patchwork quilt stitched together with the thread
of many bloodlines.
Each part of me is scattered throughout the world—
a fragment in Italy, pieces in Ireland and Scotland,
and of course, a small slice in México.

Raini Kellogg
Eighth Grade, West Marin School, Marin County
Julie Cassel, classroom teacher
Brian Kirven, poet-teacher

(from *Turning into Stars: California Poets in the Schools Statewide Anthology 2012, reprinted with permission from California Poets in the Schools*)

The Starry Night
after Vincent van Gogh's 1889 painting

A fire erupted
The night sky had a heavy wind
The moon blazed like the sun
People in the town were all awake
Wondering what to do
Lights all on
Children huddled next to their parents
It was terrifying,
But at the same time, beautiful
The stars, very bright, shone on the rolling hills
Then came a shooting star, and everything silenced
And the sky became dark except for
The stars that burned brightly all night

Skyla Bertsch
Seventh Grade, Coastal Grove Charter School, Humboldt County
Jenny Rushby, classroom teacher
Julie Hochfeld, poet-teacher

(from *Turning into Stars: California Poets in the Schools Statewide Anthology 2012, reprinted with permission from California Poets in the Schools*)

"The Starry Night", by Vincent van Gogh, 1889.

Ancestors

I hear the ancestors
In the red rocks and boulders.
Over the clouds and under the moon.
Hiding in the fire
and under the ground.

Ancestors are still there
but cannot be seen.
They hide in the dark
shadows. In the woods and
in the shallow water of
life. All over the place,
even in the flower buds.

Ali Ali
Fourth Grade, Lakeshore Elementary School, San Francisco
Sheila Tenney, classroom teacher
Grace Grafton, poet-teacher

(from *Turning into Stars: California Poets in the Schools Statewide Anthology 2012, reprinted with permission from California Poets in the Schools*)

The Moment When You Look Up
at the Clouds and Say "I Am"

I am a glance, a pause, a question,
a faded Star of David,
an uprooted live-oak tree.

I am bare feet on grass, cinnamon bun Kentucky where
fireflies flit and light the evening with
false shimmer.
I am San Francisco of Castro fairs, graffiti art,
and familiar floating fog.

I'm the lost breath as the sun rises
(sky flushed pink-red and golden beams blazing, splitting
and conquering the night as they mellow into a
watercolor blue).

I am a sad smile at the stars.

I am a single heartbeat, lost and found in the noise,
a drop in the ocean of
the city of hate and love,
simply a fleeting human (there one day, gone the next).

I am a cozy gray hoodie, a worn pink blanket.
I am one step closer to a distant rainbow.

I am a tired sigh,
a hopeful glance.

I am wondering tears, after all,
the universe is so very big, and I
am so very small.

Zoe Kaiser
Ninth Grade, Lowell High School, San Francisco
Meredith Santiago, classroom teacher
Susan Terence, poet-teacher

(from *Turning into Stars: California Poets in the Schools Statewide Anthology 2012, reprinted with permission from California Poets in the Schools*)

"I look inside me..."

I look inside me not
outside me to go to my
mind I flew away I went
to space I drank the
Milky Way I put on Orion's
Belt I threw the sun
I caught the moon
I closed in my mouth the galaxy

Siddhartha Ullah
Grade Three, New Roads School, Los Angeles County
Shelly Fredman-Fetzer, classroom teacher
India Radfor, poet-teacher

(from *My Mouth the Galaxy: California Poets in the Schools Statewide Anthology 2015, reprinted with permission from California Poets in the Schools*)

Misleading Surfaces

I love the rhythm of sad music,
the movement of true laughter,
the radiance of a real smile.
I abhor closed-minded souls,
judgment without understanding,
meaningless talks.
I am a dancer, a painter,
an author,
an adventurer,
a traveler,
a dreamer.
I am not the drug addict on the corner
sobbing over past events
with the scent of liquor on her tongue
and bloodshot eyes.
I am the constant
"huh," "um, I don't know," and "ugh."
I want to be the
"perhaps,"
"I let go of the past,"
"we only get this moment once,"
"we should live while we have the
chance."

I am the over-thinker
the rock in your shoe
a daydreamer
but I belong to the moon.

I wish to be the stars in the sky
to dance with the galaxies
as they sway through the night.

I am strong, I carry on through the pain,
courageous, I face my fears even with my
stomach tied.
Generous, I give to those in need,
caring, I'll help you when you fall.
honest, I won't deceive you
forgiving, I won't hold a grudge,
sensitive, drop me and I'll break,
but shortly after I'll be putting myself back
together
with bruised knees,
broken bones,
and a smile on my face.

Abby Obuku
Grade Nine, Pacific Community Charter School, Mendocino County
Yolanda Highhouse, classroom teacher
Blake More, poet-teacher

(from *My Mouth the Galaxy: California Poets in the Schools Statewide Anthology 2015, reprinted with permission from California Poets in the Schools*)

DAY 8

Activity: Life's Must-have's (~1-1.5 hrs)
Content adapted from the "Life on Earth…and elsewhere?" astrobiology teaching guide, courtesy of the NASA Astrobiology Institute (http://astrobiology.nasa.gov)

Learning goals: Encourage girls to explore the requirements for life on Earth, and think about how we use this information to look for life elsewhere in the universe.

Educator: Ask students "What makes a planet or a moon a good home for living things?" Have the girls write down an answer in their playbooks.

Ask girls to share some of their answers.

Bring out Earth Celestial Buddy.

Educator: "What is the one thing about the Earth that's different from all of the other planets in the solar system?"

(Girls might say "it has life/oceans/water/trees/humans", etc.)

Educator: "Yes! And what do we as humans have to have every day for us to live?"

(Wait for someone to say "water".)

Educator: Right. There are so many different types of life on this planet, from huge elephants to the smallest microscopic bacteria. But they all use water. So water is one of the things that life on Earth needs to survive. What is another thing?

Educator: "Food is also important – life needs this. Why? How do you feel when you haven't eaten in a while?" (Listen for someone to say "tired.").

Educator: "Food gives us energy! And it gives our bodies the nutrients they need to grow. How do we as humans get food?" (Answers may include: Got to the store, cook the food, pick crops, animals like cows, chicken, fish, etc.).

Educator: "Yes! Humans get our food in certain ways. But not all life eats the same kind of food. For instance, do trees go to the store to get their food?" ("No!")

Educator: "No! But trees are alive, and they grow. What do they use for food?"

Hint: "What's something that happens every day at dawn?"

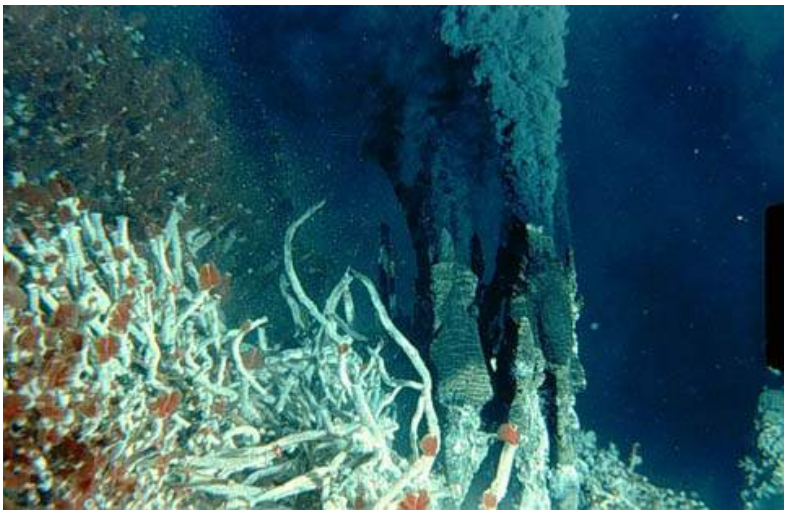
(wait for someone to mention sunrise)

Educator: "The sun comes out! Plants, trees, flowers all need sunlight as their energy source. They use that sunlight to make their food and they use it to make oxygen that we as humans need to breathe. Now, here's a tough question: Does all life need sunlight for its energy?"

Hint: "Is there life down at the bottom of the ocean? There is! And do you think that sunlight reaches all the way down to the bottom of the ocean? No. Sunlight only penetrates a little ways down. But at the bottom of the ocean, there wouldn't be any sunlight for life to use for its energy. So if there's life down there, what does it use for its energy?

Show this image:

https://microbewiki.kenyon.edu/images/d/d4/Hydrothermal-vent.jpg



A hydrothermal vent along the Juan de Fuca Ridge

Educator: "This is a picture of something called a hydrothermal vent. Hydrothermal vents are way down at the bottom of the ocean, often near volcanically active places, where the Earth's surface has broken open slightly, and heated water and minerals and chemicals escape through the vents. There are all sorts of life living down at these vents."

Show the short (3-minute) video here:

http://ocean.si.edu/ocean-videos/hydrothermal-vent-creatures

Educator: "So as you saw, there are many forms of life that use different types of food for their energy, including sunlight, and also chemicals from deep within the Earth, to survive and grow. So what things do we know life needs?"

Water
Food/Energy

Educator: "What's another thing that's important for life?"

Hint: "Are you comfortable right now in this room? Not too hot? Too cold? That's good, right? Remember how we talked about the importance of an atmosphere for keeping temperatures pretty comfortable for life? Something else an atmosphere does is keep harmful light from the Sun from hurting us. Our atmosphere does a pretty good job, but not a perfect job. How do you think I know that Earth's atmosphere doesn't keep all of the harmful light out?"

Hint: Take out a bottle of sunscreen and show the girls.

Educator: "Ever put any of this stuff on before you go to the beach or school? Well, you should! Because there is light called 'ultraviolet or UV light' that comes from the Sun, that gets through the atmosphere and could be harmful to our skin and us. That's why we need to where sunblock when we're outside. And even when it isn't sunny, the Sun's rays still reach us."

Educator: "Some planets and moons don't have any atmosphere to protect the planet from the harmful light from the Sun, or to keep temperatures from getting too hot or too cold. Would those planets and moons be good places to look for life?" (Answer: Probably not.)

-Divide girls into 2-3 teams, and pass out "Habitability Cards" and worksheet "What makes a world habitable" from the NASA Astrobiology Institute "Life in the Universe…and Elsewhere" astrobiology teaching guide. You can find it here:

http://nai.nasa.gov/media/medialibrary/2013/10/Astrobiology-Educator-Guide-2007.pdf

Note: If you can, take the habitability card pages to a copy store and print them out in color, then have them cut into cards and laminated. The girls can then share these among their teams.

Have teams pass around each planet/moon habitability card, have one of the girls read the information on the back of each card about the temperature, water, atmosphere, energy and nutrients available on that planet/moon.

Within each team, have each girl fill out the back of the worksheet, assessing the likelihood of being a habitable planet/moon for each planet/moon card. Then each team should decide on the planet/moon (other than Earth) that they would choose to look to search for life. When each team has decided on their best planet/moon for life, the team members can raise their hands to signal that they are done.

Activity: A Public Service Announcement (PSA) for Life (~45 min)

Learning Goal: Nurture a stronger relationship between each girl and a particular planet/moon; develop and strengthen communication skills while working together as a team in a low-risk environment; solidify the concept of what life needs to survive, by pursuing an in-depth study of a particular planetary environment and its prospects for life.

Once all of the teams have come up with their first choice planet/moon to look for life, have the teams work together for ~30 min to come up with a public service announcement (aka "commercial") for their chosen planet/moon. The rules:

PSA:

1. Each team member must participate
2. Must include some fact about everyday life in the PSA
3. Speak directly to the camera/audience.
4. You are speaking to NASA. They are going to fund one mission. You want the mission to go to your planet or moon!

Example: Titan PSA
"Saturn's moon Titan may not look like much of a place to live, but consider this: It is the only moon that has its own atmosphere. It has lakes. Sure, they're not lakes of water, but they're still liquid! Any life we find there will be very different than life as we know it on Earth, since all life here needs water. But there are lots of ways to do things, not just one way. **My sister loves to eat her dessert first, and then her dinner. I read magazines back to front.** So maybe there are many ways for life to exist in the universe, including in ethane lakes on Titan!"

After 30 minutes writing the script and practicing, have each team show their PSA to the other teams. (Note: If you can film this, do. It will be great to show the girls their teams' PSAs on the final day, perhaps with parents invited).

END OF DAY 8

DAY 9

Activity: My universe

Tools: Large poster board, pencils, colored pencils, markers and crayons, pens and playbooks, astronomy books.

Learning goal: To allow the girls to choose their own astronomical object or concept and explain it to the rest of the group in their own personal way, using any medium (or multiple media) we have been using throughout the workshop.

Educator: "Ok, so today is our last full day of activities before we invite your parents to come and see what we've been doing and attend the Rising Stargirls graduation ceremony. You've all been doing such incredible work this past several weeks, and I would like for your parents to get a chance to see it! So for the rest of today, we're going to focus on a project that YOU would like to do on your favorite astronomy object that you've learned about so far. "

"I would like for you to take your object – whether it's a type of star, a particular planet or moon, a constellation, some aspect of a planet like its atmosphere, an exoplanet, a galaxy – and tell us about it, either through drawing a picture that you explain to us, or writing a poem or story that you read to us, or creating a science communication piece (like the public service ads you did before) about it."

"The most important thing is that you communicate to your audience in ways that they can understand. Don't assume that they know any more than you knew when we started. Use things that might be familiar to them, from everyday life, to get them to understand something about your object. We'll do these individually. As you can see I've put out poster board, markers and other colored crayons and pencils, astronomy books and magazines in case you need some inspiration, and you have your playbooks to write in if you choose to write something."

Give girls ~ 1.5 hrs to work on their piece. Make sure to tell them to include at least 3 facts about their object in their piece or explanation, and also at least one analogy from their everyday lives that other people in the audience could possibly relate to (ex. Taking a shower, eating, riding the bus, sleeping, getting on an airplane, riding in a car).

At the end of the time, have everyone get back together and show each other their pieces! Then decide which pieces to show at parent's day.

[**Note:** If some of the girls do not want to share their pieces on parent's day, that's ok. They could share some of their artwork from earlier in the workshop (Soft pastel drawings from Art and the Cosmic Connection, exoplanet drawings from "Design Your Own Exoplanet", constellations and origin myth stories from "Make Your Own Constellation", group poems or PSAs from "Make Your Own Poem" or ""A PSA for

Life". Ask the girls if they are comfortable sharing any of these, or if they would be comfortable if they had another girl with them while they explained their piece to the audience. Try to make sure every girl is represented in some way on parent's day.]

IMPORTANT NOTE: On this last day before the graduation ceremony and presentations, be sure to leave time at the end to conduct the assessment questions from Day 1 again, and have the girls record their answers in their playbooks. Collect them and record their responses before the final day and ceremony. Then you can give the playbooks to the girls to take home and keep on the last day.

END OF DAY 9

DAY 10

Activity: Parent's visit day, final presentations sharing, and graduation ceremony

Prepare a certificate with each girl's name on it signifying her graduation from the Rising Stargirls program. Make sure that she understands that she is a Rising Stargirl forever, and encourage her to continue to shine!

Order pizza! Have snacks and non-alcoholic drinks. Make it a party!

You may also elect to raffle off astronomy themed prizes during the party. And be sure to give the girls their playbooks back to keep (make sure you have recorded anything for your documentation purposes in advance!)

Encourage each girl to share one of her projects from the workshop. Keep the atmosphere casual. You may display artwork from earlier in the workshop (Constellations and origin myths, exoplanet drawings, soft pastel artistic interpretations from "Art and the Cosmic Connection", planet mnemonics). Try to immerse the parents in the work of their daughters, including the theater pieces and poems that some of the girls will present. Perhaps during Day 9, decide to have one of the girls "Emcee" the event, and introduce each girl to share. Or you as the Educator can be the emcee.

Enjoy the day of celebration!

ADDITIONAL ASTRONOMY AND ASTROBIOLOGY RESOURCES

Encourage your girls to continue along their individual and personal pathways of astronomical discovery after the program. Here are some resources that you can share with the girls and their families (perhaps print these out on cards to give to the girls and their parents on the final day).

NASA Women in STEM (Science, Technology, Engineering, and Math)
http://www.nasa.gov/education/womenstem
Learn about many of the women working for NASA (National Aeronautics and Space Administration) who are scientists, engineers, mathematicians, and astronauts!

NASA Education (http://www.nasa.gov/offices/education/about/index.html)
Click on "NASA Kids Club" or "For Students" and "Grades 5-8" or "Grades 10-12" for activities and information about space aimed just for kids your age!

MicroObservatory online telescopes
(http://mo-www.cfa.harvard.edu/MicroObservatory/)
Explore the universe with telescopes you control over the internet!

ADDITIONAL ASTRONOMY AND ASTROBIOLOGY RESOURCES (CONT'D)

Curious About Astronomy (http://curious.astro.cornell.edu/)
Learn more about the solar system and beyond, and ask real astronomers questions!

PlanetQuest (http://planetquest.jpl.nasa.gov/)
Learn about the latest exoplanet discoveries!

NASA Astrobiology Institute (http://nai.nasa.gov/education-and-outreach/)
Learn more about Astrobiology and how different types of scientists use their backgrounds to understand how life on Earth started and developed, and what other types of life might be out there!

Astronomy Picture of the Day (http://apod.nasa.gov/apod/astropix.html)
Every day there is an amazing image or photo of the incredible universe posted, along with an explanation of the photo by a professional astronomer!

Keep looking up!

www.risingstargirls.org

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