

• ASTROPHYSICS AND INDIGENOUS STAR KNOWLEDGE WITH PROFESSOR RAJA GUHATHAKURTA, DR AMANDA QUIRK, AND PROFESSOR ANNETTE S. LEE

• TALKING POINTS

KNOWLEDGE:

1. Which element could be found in both your body and the early Universe before the formation of the first stars?
2. What three things can the spectrum of a star tell us?

COMPREHENSION:

3. Why do massive stars collapse at the end of their lifetimes?
4. Why do no stars crash into each other when two galaxies collide?
5. How would you describe the technique of spectroscopy?
6. What is Two-Eyed Seeing?

APPLICATION:

7. How did astrophysicists discover that Andromeda is on a collision course for the Milky Way? How would you assess whether the Milky Way is going to collide with Triangulum?

ANALYSIS:

8. What are the benefits and limitations of learning through answering textbook questions? Why does this method not prepare you for solving problems in the real world?

SYNTHESIS:

9. If we had a spaceship that could travel at the speed of light, how long would it take to get a photo of the Milky Way, taken from outside our galaxy, and to return this image to Earth?
10. Why does being in a galaxy make it more likely that life will form?
11. If life on Earth still exists in 4.5 billion years' time, how do you think it would be affected by the collision with Andromeda?
12. Which is hotter: the red flame of a wood fire or the blue flame of a gas cooker? How do you know?

EVALUATION:

13. To what extent do you agree that Two-Eyed Seeing is the best way to understand the stars?
14. Raja, Amanda, and Annette are all passionate about art as well as astronomy. Do you believe that art and science are distinct and separate fields? To what extent do you think art and science should be combined? How can each be used to inspire and influence the other?

• MORE RESOURCES

Visit Raja's website to learn more about his team's work investigating galaxies:

app.ubinum.com/lab/raja-ucolick-observatory

Raja talks about astronomy and the importance of failure: www.youtube.com/watch?v=ZOWTzVNB2g4

Amanda won the UCSC Grand Slam competition with her presentation about galactic cannibalism: www.youtube.com/watch?v=s2E6dqRrw9U

Learn more about the Science Internship Program: sip.ucsc.edu

Eavesdrop on research at an astronomical telescope through Shadow the Scientists: shadow.ucsc.edu

Find out more about Native Skywatchers and their upcoming events: www.nativeskywatchers.com

Learn more about Native Skywatchers - We Are Stardust and watch students talking about their connections with the stars: www.nativeskywatchers.com/nativesky-stardust.html

Watch the video Rue created for her We Are Stardust project: www.vimeo.com/603069812

Visit Annette's website to view her artwork: www.annettelee.com

Explore exhibits combining art and astrophysics in the USCS OpenLab: www.openlabresearch.com/art-astrophysics

Rue and Noku founded Junior Space Explorers to inspire young Zimbabweans to learn more about astronomy: www.juniorspaceexplorers.com

Learn more about Annette's work: astrophysics.usq.edu.au/about-us/annette-lee; sfis.asu.edu/profile/alee136

ACTIVITIES

WHAT DO THE STARS MEAN TO YOU?

Have a group discussion about your own cultural relationships with the stars. Start by talking about the word 'star':

- What do you think and feel when you say or hear the word 'star'?
- What does it mean to describe a person as a 'star'?
- How many phrases can you think of that include the word 'star', and what do they mean?

Now, think about your experiences with the night sky:

- How often do you see the stars?
- Have you ever looked through a telescope at night?
- Do you remember the first time you saw a starry sky? How did it make you feel?
- How many objects in the night sky could you name?

Finally, try to discover your true connection to the stars. Here are some questions to get you thinking. What differences and similarities do you have to your classmates?

- What did you think the stars were before you learned about them at school, and why? Do you still believe that or has your perception changed?
- Now that you know you are made of stardust, does that change the way you feel about the stars? Do you feel a spiritual connection as well as a physical one?

CONNECTING THE DOTS

Cultures around the world see different patterns in the same stars. Have a look at the Native Skywatchers' star maps as an example (www.annettelee.com/index.php/portfolio/star-maps). In these maps, the Ojibwe, D(L)akota and Ininew-Cree constellations are drawn in bold colours, while the 'Greek' constellations are shown in pencil.

For this activity, work in pairs or small groups. You will need drawing materials including paper/tracing paper and pens/pencils/crayons.

1. With your partner/group, sketch out an imaginary night sky. Take turns to draw a star wherever you like on the page, making some bigger and some smaller, until you have about 15–20 stars.
2. Lay another sheet of paper over the top of your night sky and trace the exact same star pattern onto it.
3. Split up from your partner/group, each taking a copy of your night sky.
4. What patterns do you see in the stars? Create constellations based on the stars in your night sky. Use your imagination to create your own star map.
5. When you have finished, rejoin your partner/group and compare your star maps. Did you see the same constellations in your set of stars, or different ones? Why do you think that was?