

CURRICULUM GUIDE

978-1-4197-3626-1



THE STUFF BETWEEN THE STARS

HOW VERA RUBIN
DISCOVERED MOST
OF THE UNIVERSE

BY
Sandra Nickel
ILLUSTRATED BY
Aimée Sicuro

VERA RUBIN WAS ONE OF THE ASTRONOMERS who discovered dark matter, the thing that keeps the universe hanging together. Throughout her career she was never taken seriously as a scientist because she was one of the only female astronomers at that time, but she didn't let that stop her. She made groundbreaking and incredibly significant discoveries that scientists have only recently been able to appreciate.

A stunning portrait of a trailblazer, *The Stuff Between the Stars* tells Vera's incredible story, celebrates her brilliance, and shows how a girl's never-ending love for the night sky forever changed the way we see our universe.

"This engaging biography will appeal to budding scientists, particularly those with a penchant for sky searching. . . . [Rubin] shows it's cool being a highly intelligent, science-loving female." —KIRKUS REVIEWS

"A truly beautiful story of perseverance and passion."—BOOKLIST

srandranickel.com

aimeesicuro.com

abramsyoungreaders.com



ABRAMS

The Common Core State Standards addressed by the discussion questions and activities in this guide are noted throughout. For more information on the Common Core, visit corestandards.org.

DISCUSSION QUESTIONS

Unless otherwise noted, all discussion questions align with the following Common Core State Standards: [CCSS.ELA-LITERACY.RL.1.1](#); [CCSS.ELA-LITERACY.RL.2.1](#); [CCSS.ELA-LITERACY.RL.3.1](#); [CCSS.ELA-LITERACY.RL.4.1](#)

- ★ Vera Rubin became fascinated by the night sky at a young age. What was Vera’s early inspiration for studying the stars?
- ★ How did Vera’s high school teacher and a college admissions officer react to Vera’s interest in astronomy? What was Vera’s response to the advice she received? [CCSS.ELA-LITERACY.RL.1.3](#); [CCSS.ELA-LITERACY.RL.2.3](#); [CCSS.ELA-LITERACY.RL.3.3](#); [CCSS.ELA-LITERACY.RL.4.3](#)
- ★ The mysteries of the universe sparked many questions in Vera’s mind. What was Vera’s first big question about galaxies?
- ★ How did Vera’s emotions change from when she discovered an answer to her big question to when she shared her findings with other astronomers? [CCSS.ELA-LITERACY.RL.1.3](#); [CCSS.ELA-LITERACY.RL.2.3](#); [CCSS.ELA-LITERACY.RL.3.3](#); [CCSS.ELA-LITERACY.RL.4.3](#)
- ★ Vera continued to wonder about how the galaxies worked. She thought of a second big question about the universe to investigate. What was it and what happened when Vera was able to answer this important question?
- ★ Why was Vera interested in the Carnegie Institution’s observatories in the California mountains?
- ★ What did Vera discover about “dark matter” and how stars move on the edge of the galaxy?
- ★ What happened that finally led senior astronomers to accept Vera as a fellow astronomer?
- ★ The author describes Vera Rubin as someone who “dreamed about the mysteries between the stars.” What lessons did Vera learn about herself as a result of her dreaming about the mysteries of the universe? [CCSS.ELA-LITERACY.RL.1.2](#); [CCSS.ELA-LITERACY.RL.2.2](#); [CCSS.ELA-LITERACY.RL.3.2](#); [CCSS.ELA-LITERACY.RL.4.2](#)
- ★ Vera famously said, “Each one of you can change the world, for you are made of star stuff, and you are connected to the universe.” What do you think about this statement? How does it make you feel?

The discussion questions and activities in this guide were created by Leigh Courtney, Ph.D. She teaches in the Global Education program at a public elementary school in San Diego, California. She holds both masters’ and doctoral degrees in education, with an emphasis on curriculum and instruction.

ACTIVITIES FOR STUDENTS

FACING A CHALLENGE

Vera Rubin faced many obstacles as she followed her dream of being an astronomer. Even through the challenges, Vera showed grit and perseverance. She did not give up; she kept trying to find answers to her big questions about the universe. Have you faced challenges in your life when you were trying something new and unknown—like learning to ride a bike, play an instrument, or solve long division problems? Think about how you felt as you tried to learn something new. Why was this new skill important to you? What steps did you take to reach your goal? Write a personal narrative about this process where you showed perseverance much like Vera Rubin did as she tried to reach her goal of becoming an astronomer. [CCSS.ELA-LITERACY.W.1.3](#); [CCSS.ELA-LITERACY.W.2.3](#); [CCSS.ELA-LITERACY.W.3.3](#); [CCSS.ELA-LITERACY.W.4.3](#)

SKY MYTHS

The night sky is full of constellations of stars, including Orion, Aries, Cassiopeia, Ursa Major, and many others. Ancient stargazers on Earth connected these groups of stars like dot-to-dot puzzles to form pictures of their gods and figures, creatures, and objects from their world. The ancient Greeks and Romans had mythical stories to go with these “star pictures.” Select one constellation and research the myth associated with it. Write a short, informative report about the constellation and its myth. [CCSS.ELA-LITERACY.W.1.2](#); [CCSS.ELA-LITERACY.W.2.2](#); [CCSS.ELA-LITERACY.W.3.2](#); [CCSS.ELA-LITERACY.W.4.2](#); [CCSS.ELA-LITERACY.RL.4.4](#)

CONSTELLATION IN A CUP

Vera noticed stars and constellations of stars as she looked into the night sky. Recreate a familiar constellation using a paper cup, a pencil, a wooden skewer, and a small flashlight. Research the layout of your favorite constellation and use a pencil to draw dots on the bottom of the cup representing the position of the stars. Next, carefully use the wooden skewer to poke holes on the bottom of the cup where you drew the stars. Finally, place the small flashlight inside cup and turn it on. Shine your constellation onto a dark wall.

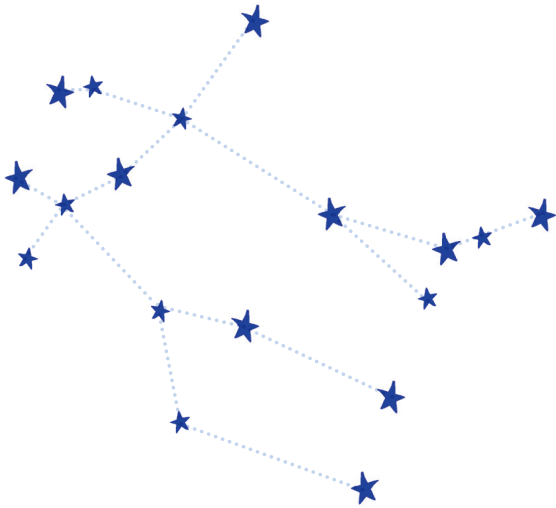
MAKE A TELESCOPE

When she was young, Vera used a homemade telescope to study the stars outside her bedroom window. Try designing your own homemade telescope using two empty paper towel tubes, scissors, masking tape, and two convex lenses from an old pair of reading glasses. (Pop the lenses out of the eye glass frames for use in the telescope; use magnifying reading glasses, not glasses for distance viewing. You can also purchase convex lenses online.) Start by cutting one tube lengthwise the total length of the tube. Make the cut tube narrower by tucking one edge of the cut side within the other and squeezing to curl the roll within itself. Slide one end of this narrower tube into the whole tube. Push it in several inches and then release your grip so that the cut tube can expand into the other tube. Use the masking tape to affix one of the convex lenses to the outer edge of the inner (cut) tube. The curve of the lens should be facing inside the tube. Then secure the other lens to the outer edge of the uncut tube. The curve of this lens should be pointed outward. The lenses may be bigger than the paper towel tubes, but that’s okay! Put your eye up to the lens on the inner tube. Slide the inner tube in and out of the outer tube (be careful to not slide it all the way out!) until the object you’re looking at comes into focus.

NAME: _____

NAME THAT CONSTELLATION

A constellation is a group of stars that form a particular shape when viewed from Earth. There are 88 named constellations in the night sky. Many were first discovered and named by the ancient Greeks centuries ago. The constellations pictured below looked like something significant to those ancient stargazers. Can you match each constellation to its name?

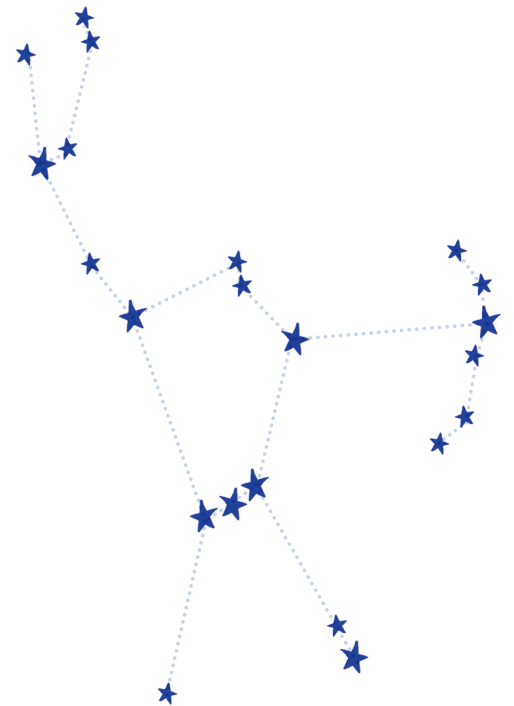
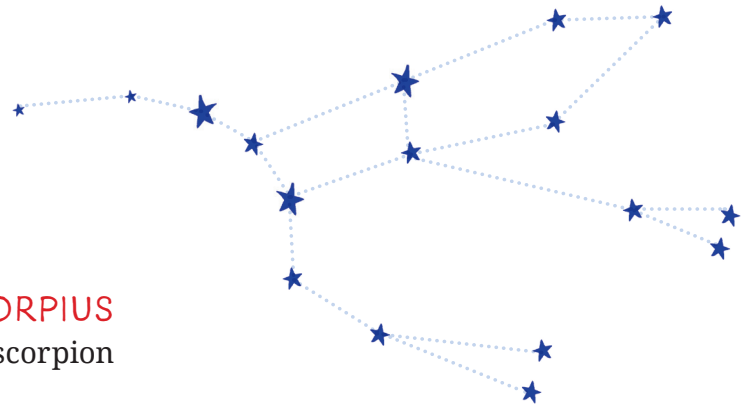


SCORPIUS
the scorpion

URSA MAJOR
the great bear

GEMINI
the twins

ORION
the hunter



NAME: _____

THE VIEW OUTSIDE VERA'S WINDOW



When Vera was a young girl, she often stared at the night sky through the window of her small bedroom. What do you think she saw? Stars? The moon? A passing comet or rocket ship? Pretend you are Vera and draw the view from her window. What do you think inspired her to want to study the universe? On the lines below your picture, write about what you find most fascinating about the night sky.

CCSS.ELA-LITERACY.W.1.3; CCSS.ELA-LITERACY.W.2.3; CCSS.ELA-LITERACY.W.3.3; CCSS.ELA-LITERACY.W.4.3

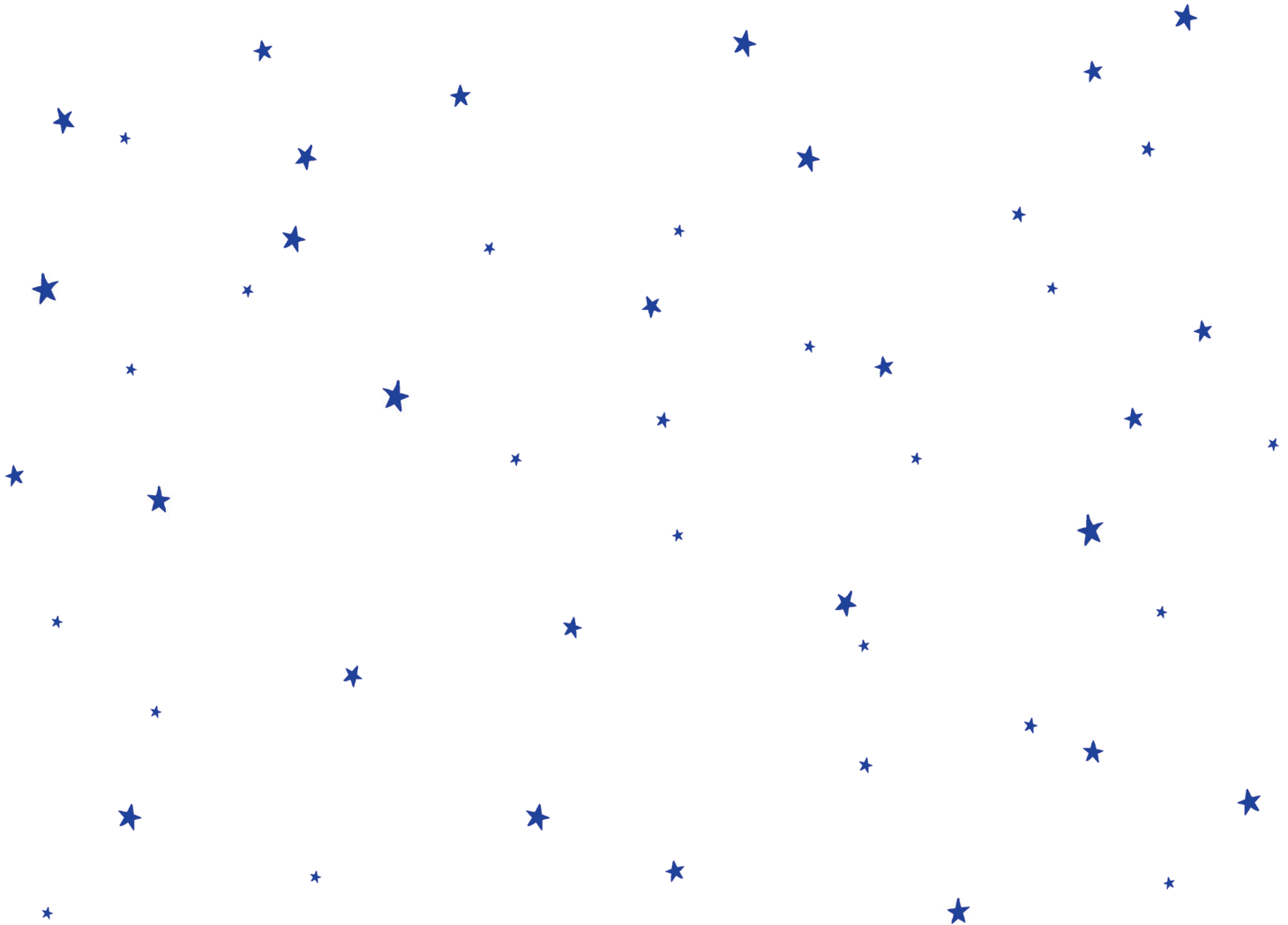


NAME: _____

CREATE YOUR OWN CONSTELLATION



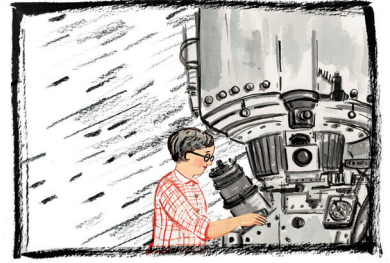
Vera could see the Big Dipper and many other constellations in the night sky when she was studying the mysteries of the universe. Now it's your turn to create your own original constellation. Think of something that you like or that is important to you. Next, think how it can be shown as an item or a symbol. For example, if you love camping, you might use a tent as a symbol. In the star field below, use straight lines to connect stars to represent your symbol.



Name your constellation and describe what it represents and why you chose this item or symbol.

NAME: _____

ASTRONOMY GLOSSARY



Vera had to learn and use many scientific terms when she studied to become an astronomer. Look through the book to find five important words about astronomy. Use these words to create a glossary for *The Stuff Between the Stars*. List the words in alphabetical order and write a definition for each. Use the information in the story to help you create definitions for each term. **CCSS.ELA-LITERACY.RI.1.5; CCSS.ELA-LITERACY.RI.2.5**

1.

2.

3.

4.

5.
