Curiosity, Opportunity, Discovery, Challenger, Enterprise, Endeavour, Perseverance, Pioneer, Odyssey, and Pathfinder are more than familiar names of space missions (see Online Resources). They are also appropriate adjectives that, in a way, describe us—human beings. We are curious, and for some of us that curiosity leads to opportunities that without some ambition may never materialize. This does not always lead to satisfactory results, however, as you can hear in “Ambition,” a short video from the European Space Agency (ESA) about the Rosetta Mission to a comet, “Ambition, stubbornness . . . we fall, we pick up ourselves again, and we adapt” (see Online Resources).

What does it mean to explore or to be an explorer? And to be clear, the word explore is not something limited to the sciences. For example, a person may explore new territory while hiking, which is typically how we think of explorers like the Lewis and Clark team, Christopher Columbus, and others who expanded our boundaries physically. However, one may also explore new territory by exploring the lunar surface and other worlds telescopically, or through nonphysical endeavors in the fields of mathematics, engineering, literature, and the arts. For example, names like Johannes Kepler, Marie Curie, Thomas Edison, Albert Einstein, Carl Sagan, and Henrietta Leavitt come to mind as explorers, but in their own respective fields. The point is that to explore or to be an explorer is not necessarily just a physical endeavor.

Explore some explorers by going to the NASA Solar System Exploration website (see Online Resources) and under “More” follow the link to “People” and then to “All People.” This will allow a student to select an “Area of Focus” with interesting biographies about the many NASA employees from different careers—scientists, engineers, administrators, and so on—involved with that particular Area of Focus. Students learn about how these people became
interested in their careers and the path or paths they explored and followed to get to where they are now with NASA. Another interesting page on the website has a listing and biographies about “Notable Explorers” (see Online Resources).

**But why do we explore?**

That question is, at times, a challenge to answer. For example, why are we teachers? Why do people do what they do? What brings us to wonder or be curious? Science Scope readers may think that my science passion is astronomy because I write about it (it is), but it is the geology/geography of landforms wherever they may be located (Earth or another world)—and especially mountain-forming processes—that really get me curious and wondering. I am a hands-on and feet-on learner, so whenever possible I satisfy that curiosity by spending time with mountains in high-altitude hiking and some climbing. When asked why, especially at “my age,” I could quote British mountaineer George Mallory’s answer—“because it is there” (see Online Resources) or my own mantra, “Where there is a hill and a will, there is a way.” On the other hand, I seem to lose people if I try to explain my interest in landforms and how the processes shaped them into how we see them now. Try saying geomorphology quickly three times! Whatever the explanation, very often someone will answer the “why” question with something like “it is the way I am wired” or “it’s in my DNA.” See the opening sentence in this column for possible answers to this question.

For your students, personalize this question by asking them what interests them and how or why they do what they do—academics, sports, hobbies. What do they gain or benefit from these? Answers to these questions could lead our middle school students to consider careers and their path to their goal. As a science teacher, my preference has typically been to encourage asking “how” questions; however, for the most part, we know the “how” of exploring so it is okay to wonder about

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**FIGURE 1:** Why We Explore poster.
Visible planets

Mercury starts this two-month period in a close conjunction with Saturn in the morning skies before the Sun rises. This innermost planet will move to the opposite side of the Sun and superior conjunction, before reappearing as an evening planet toward the middle of April.

Venus will be an interesting planet to observe in the morning presunrise hours over the next two months as it moves eastward passing Mars, Saturn, and Jupiter, in that order. Watch for a very close conjunction with Jupiter on April 30.

Mars will be visible over the eastern horizon before sunrise during the next two months. It will be in a unique conjunction with Venus, Saturn, and the waxing crescent Moon on March 28.

Dwarf planet Ceres will be traversing nearly the entire length of Taurus the Bull. While not visible to the unaided eye, it could still be followed with optical assistance or astrophotography.

Jupiter will be visible above the eastern horizon as it rises about 1–2 hours before the Sun during this two-month period.

Saturn rises about 2–3 hours before the Sun rises and, like Jupiter, will be visible over the eastern horizon at sunrise.

“why” we explore.

So why do we explore? And what do we gain by exploration? At the NASA Beyond the Earth website, students can read brief statements explaining answers to questions starting with “why” that relate to the ISS (International Space Station), trans lunar space, asteroids, and Mars (see Online Resources; see also Figure 1).

What are the benefits of exploration?

If it is space exploration, then this could be answered, somewhat with tongue-in-cheek, by the flavored drink Tang. But the answers to this question really are much deeper than that, as the biographies and other information your students may be reading show.

In the science classroom or any other classroom, students are engaged in exploring as they learn about new topics or by expanding on their prior knowledge. In the science classroom our students explore by way of projects and activities done independently or as part of a group. For the latter, by creating a classroom community of science exploration teams, students benefit by working much the same way that scientists and engineers work—collaboratively. In a group or groups, students in a classroom could plan a variety of collaborative activities or projects after first working out the parameters of the activity or project. The decision on what these parameters should be would be best determined by the students.

For a group project or activity to work in a community-based classroom, the teacher should be aware of the many different reasons why a student may be resistant to participating or learning science—or even learning in general. Resistance may be because of cultural differences, authority figures, or social interaction with others, but nonetheless it should be understood that within a classroom community “classrooms collectively explore and make sense of phenomena—which requires that all students feel comfortable contributing and that differences in how they contribute are respected” (see “How to build an equitable learning community” in Online Resources). All cultures have a common connec-
tion with the night and day sky, but it is probably the night sky where different cultural beliefs or stories are the most prevalent. As a writing project, students could interview older family members about the night sky and then write about what they learn. Sometimes what they learn originates from their family cultural history (e.g., based on the family’s origin). This cultural awareness, or to a certain extent a lack of awareness, is some of what students could bring to our science classrooms as preconceptions.

Within a community-based classroom, as it evolves and matures, students begin to bond as they work and explore collaboratively together. Over time, students and the teacher get to know one another better. That thought reminds me of a quote from T. S. Elliott: “We shall not cease from exploration. And the end of all our exploring will be to arrive where we started and know the place for the first time” (see The Quotations Page in Online Resources).

**Explore your space**
The card and board game NASA Space Voyagers: The Game (see Online Resources) has students working to design and build a spacecraft for exploring our solar system. Students use problem-solving skills and their knowledge of and research into STEM and space exploration concepts to win. Winning is determined by completing a mission and accumulating the most exploration points. All materials are downloadable for printing locally. One exciting offshoot of playing this game is that students are introduced to NASA’s Artemis missions and could potentially participate in the Artemis Generation challenges (see Online Resources).

At the NASA JPL projects website there is a coding project, Code a Mars Helicopter Video Game, for students to write the code for a video game that allows for exploring Mars with a helicopter. Students will write the code using the Scratch coding language to enable the helicopter to not only fly, but also to take off and land at designated places. To do so, they will need to set up a free account (see Online Resources).

Exploring the night sky for objects in our solar system or in other solar systems, or learning how to find constellations and stars in your local night skies, can be ways to introduce students to astronomy as a hobby or potentially a future career. A handy tool for exploring the starry night sky is a planisphere, a rotating star map that may be set for a date and time. This is a useful tool for finding stars and the patterns they make; however, planets are not shown on this type of a map. The Stelvision website (see Online Resources) has an online version of a
### March
- **02** Mercury–Saturn conjunction
- **05** Jupiter in conjunction with Sun
- **08** Moon at ascending node
- **10** First quarter Moon
- **12** International Day of Planetariums
- **13** Daylight Saving Time starts
- **14** Waxing gibbous Moon near Beehive Open Star Cluster
- **15** Waxing gibbous Moon near Regulus
- **17** Mercury 1.2° of Jupiter
- **18** Full Moon
- **19** Waning gibbous Moon near Spica
- **20** Venus at greatest elongation: 46.6°W
- **21** Moon at descending node
- **23** Waning gibbous Moon near Antares
- **24** Moon at ascending node
- **26** Earth Hour
- **27** Waning crescent Moon near Mars
- **28** Waxing crescent Moon near Saturn
- **29** Venus–Saturn conjunction

### April
- **01** New Moon
- **02** Mercury at superior conjunction
- **04** Moon at ascending node
- **07** Moon at apogee: 251,306 miles [404,438 km]
- **09** First quarter Moon
- **10** Waning gibbous Moon near Pollux
- **12** Waning gibbous Moon near Beehive Open Star Cluster
- **13** Mercury at perihelion
- **16** Waxing gibbous Moon near Spica
- **18** Moon at ascending node
- **19** Moon at perigee: 226,889 miles [365,143 km]
- **20** Lyrid meteor shower
- **21** Earth Hour
- **22** Earth Day
- **23** Last quarter Moon
- **25** Waning crescent Moon near Mars
- **26** Waning crescent Moon near Venus
- **27** Waning crescent Moon near Jupiter
- **29** Mercury at greatest elongation: 206°E
- **30** New Moon

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A planisphere is a graphical representation of the night sky that can be used to show the positions of celestial objects for any selected date and time. Students can set the map for their birthday or birthdate to see the sky or set it at historic times—at least at what stars were above the horizon. See Online Resources for a free downloadable and printable version of a planisphere.

Also, there is a basic telescope simulator at the Stelvision website that will allow students to explore how the size of the mirror or lens affects the amount of light collected and how the object may appear through the eyepiece. While just a simulation, this is a good introduction to what telescope images could look like.

Imaging celestial objects is at
the heart of the DIY Planet Search, a part of the MicroObservatory Telescope Network, a system where individuals may send imaging requests to a remote robotic telescope (see Online Resources). An email address is required to set up an account. This site operates much like the Observe with NASA website, where pictures of solar system objects, other galaxies, and nebula, for example, are requested. The difference between the Observe with NASA website and the DIY Planet Search website is that requests are made for images of stars that are potential exosolar systems, stars with planets. Students make their requests as they join a search for planets orbiting stars in our galaxy. Over time, students will have collected images of a star that they will use to analyze its light and how it may have changed over time. That change, if any, could be caused by a planet in transit across the disk of the star. Students will be able to share images and data with others as well as analyze data from others. The website has a lot of support materials—including information about exo-planets, telescopes, tutorials, and (very important) the stellar targets—to choose from for imaging or data already collected (see Figure 2).

ONLINE RESOURCES

Ambition—bit.ly/3mmAhCi
Artemis Generation—stem.nasa.gov/artemis/
Because it is there—bit.ly/3u5oFae
Beyond Earth—www.nasa.gov/exploration/whyweexplore/why_we_explore_main.html
Code a Mars Helicopter Video Game—go.nasa.gov/39TLnW
Earth Day—www.earthday.org/
Earth Hour—www.earthhour.org/
First Picture of Earth from Lunar Surface—bit.ly/3yu1ayG
How to build an equitable learning community in your science classroom—stemteachingtools.org/brief/54
List of of Space Exploration Missions—www.collegenp.com/technology/list-of-space-missions/
List of NASA Missions—www.nasa.gov/missions
Mars Explores Wanted Poster—https://go.nasa.gov/3JB3r1U
MicroObservatory Telescope Network—mo-www.cfa.harvard.edu/MicroObservatory/
NASA Solar System Exploration—solarsystem.nasa.gov/
NASA Space Voyagers: The Game—https://go.nasa.gov/3AUU3eV
NASA Exploration: Beyond Earth—nasa.gov/exploration/
Why We Explore—https://go.nasa.gov/3GpUkaoD
NASA Notable Explorers—go.nasa.gov/3tQLxtC
Online Planisphere—www.stelvision.com/en/
Partial Solar Eclipse—moonblink.info/Eclipse/eclipse/2022_04_30
Pi Day—www.piday.org/
Planisphere [free]—oasny.org/Starwheel.pdf
Scratch—scratch.mit.edu/
STEM Lesson Plans—go.nasa.gov/3KvccSP
Using Phenomena in NGSS—Designed Lessons and Units—stemteachingtools.org/brief/42
Why We Explore Poster—go.nasa.gov/3D0Ydnf
Yuri’s Night—yurisnight.net/

For students

1. Here are a few more names of explorers who may have been the first at what they accomplished. So, what did they do? James Beckworth; John Colter; Bessie Coleman; Barbara Washburn. Who can you think of in addition to these explorers?

2. Use the Observe with NASA [OWN] telescope to request pictures of Ceres several times each week during March and April to follow its path across the constellation Taurus the Bull.

3. There are several special days during March and April to celebrate or acknowledge, from Pi Day to Earth Hour and Earth Day, to Yuri’s Night, and others. What will you take part in? [see Online Resources].