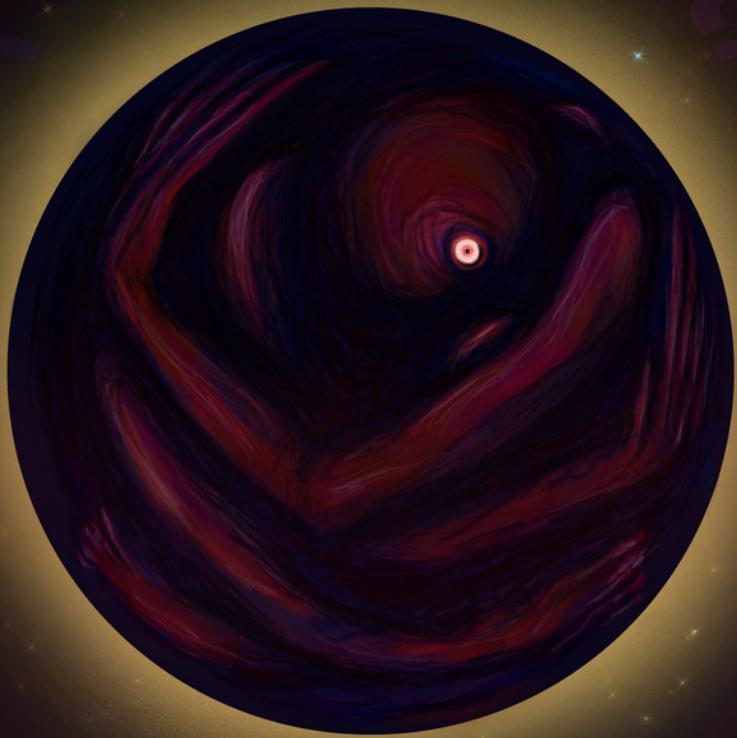


FarFarOut!



Shadows of the Ecliptic

Volume 2, Issue 3

October 2023



STAR Society

South Texas Astronomical Society

Editorial

Stand still, O sun, at Gibeon, O moon, in the valley of Ajalon! And the sun stood still, and the moon stayed, while the nation took vengeance on its foes. Is this not recorded in the Book of Jashar? The sun halted in the middle of the sky; not for a whole day did it resume its swift course.

Although the biblical story of Joshua's victory is usually taken as literal, there is a scientific case that the event was an annular solar eclipse – the earliest recorded case [1]. An annular solar eclipse occurs when the Moon, a bit farther away in its orbit, passes in front of the Sun. The eclipse is not total, but is associated with a "ring of fire" or "annulus" shape – hence its given name. For those of us in the Northern Hemisphere, we have the opportunity to witness an annular solar eclipse this month. The ancient recording of eclipses around the world has helped scholars place constraints on historical dates and determine the change in the Earth's motion over the millennia. And, before the modern scientific explanation of eclipses, humanity watched in awe and wonder as the ever-present Sun was briefly – but terrifyingly – eaten and swallowed whole by the all-too-familiar Moon. We share in that same human trait of awe and wonder today – albeit with a much more comforting interpretation.

In this edition of FFO, we present tales and treasures of the fall night sky in all of its wonder. As the summer transitions to fall and the frigid air meets us with a cold embrace, the sky changes and many famous constellations appear. One of these is the little fox, Vulpecula, who greets us from among the pantheon of ancient beings in the starry sky. We will hear of a tale of a young man who knew the secrets of the Sun. We will take our first steps at understanding the role of the dark sky in our lives, learning the principles for responsible outdoor lighting, and beginning a dark sky journey for our community. We will hear of the recent communication between local Brownsville students and astronauts aboard the International Space Station. And, continuing our new Space Ranger section, we present some eclipse coloring, word searches and puzzles, and many lovely pieces of artwork.

Wishing you clear skies,

Richard Camuccio
Editor-in-Chief

[1] <https://doi.org/10.1093/astrogeo/atx178>

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Carol's Corner of the Cosmos

Carol Lutsinger



The onset of autumn is one of the special astral events for our planet. Since we are tilted on our axis on average 23.5 degrees, we have seasons across Earth due to the number of sunlit hours specific parts of our sphere experience. If we were upright each place on Earth would always have the same season and the same hours of daylight and darkness. You may have noticed the Sun's position changing along the horizon as you head to and from work each morning. If not, pay attention as you drive on your town's streets and highways.

Stargazers are excitedly waiting for the October 14, 2023 annular solar eclipse. Be prepared with your ISO-approved protective glasses. Sunglasses ARE NOT AN OPTION! Instead, use Welder's glasses #14, or stand with your back to the Sun and use a pinhole viewer. Be safe, not sorry [1].

An *eclipse season* is a five-month period of time during which there is one solar and one lunar eclipse, with opportunity occasionally for a third eclipse during the period. Africa, Europe, and Asia will experience a partial **lunar** eclipse on October 28th during this eclipse season. Only the northeastern part of the US will experience the tandem lunar eclipse. Amazing what being a bit off-kilter can accomplish!

Our Texas solar eclipse event on October 14th will be a great spectacle if we have clear skies. The path arcs across Texas from west to south, and folks are spending small fortunes to spend the night in hotels and Airbnbs across the path of totality. Texas can boast hosting another TOTAL eclipse passing through on April 8, 2024. According to the US Naval Observatory the October 14th eclipse will begin at 10:03 AM CDT when the Moon's hazy outer shadow first touches Earth, over the Pacific Ocean.

Annularity (the ring) begins at 11:12 AM and ends at 2:46 PM. Times in Brownsville will be a bit different, but not by much and we will NOT see the ring, but a partial eclipse. NASA features a map for the path of totality [2].

Earth is a geologically active planet with intense human activity; even the fact that we are using ground water prodigiously is affecting our tilt. Sometimes I wonder if a little knowledge is a good thing since we seem to panic about ongoing changes as each one is announced, when it didn't bother us until we learned of it. But I do like to know what discoveries are being made via scientific investigations. Being informed doesn't mean we have to panic, but encourages us to look for better ways to do things.

Because our Solar System is so predictable mathematically, we can predict solar and lunar eclipses down to the precise minutes and seconds. We regularly send spacecraft to distant places to study interstellar space, what the Sun's activity is, whether there is a habitable planet in our Solar System, or even if there is water or some sign of life (even microbial) on our neighboring planets.

Stargazing in September in the early morning hours brings Venus as the Morning Star and a preview of the winter constellations. As our merry-go-round planet takes us whirling though space while it rotates on its axis, we are treated to a kaleidoscope of constellations, galaxies, and nebulae. Meteor showers regularly spew those falling stars we are told to catch or make a wish upon and one might even glimpse the International Space Station passing 250 miles overhead with its crew of intrepid adventurers learning new things about improving living on Earth and how to live in space.

September evening skies from dark sites will expose a stargazer to the Summer Triangle asterism group overhead, with Cygnus near the zenith, Lyra slightly to the west, and Aquila stretched toward the southern horizon [3].

Cygnus is such a lovely constellation, and before my neighborhood was overwhelmed with light pollution, one could enjoy the view of Deneb in the tail of the swan (or the hilt of the sword), the blade outstretched toward Altair in Aquila. The tip of the sword or the nares of the swan are actually several stars together named Alberio. "Beautiful Albireo AB" will give you some up-to-date information about this group [4].

In the east by 9:00 PM the Great Square (or baseball diamond) of Pegasus will be well up for viewing. This window into outer space has no resemblance to a horse, nor does Andromeda, the crooked V of stars drifting off first base, resemble any human. But mythology is a wonder in itself and who are we to argue when the beauty is in the eye of the beholder?

Between Pegasus and the Summer Triangle is a delicate little tailed trapezoid known as the Dolphin, Delphinus [5]. It is often mistaken for the Little Dipper asterism by those folks who don't have a compass to direct them north. By late October these constellations will be farther west.

The north part of the sky will have the circumpolar constellations rotating counterclockwise and those star-finding phone apps will reveal the outlines of constellations which might enhance your stargazing experience. Here in South Texas the North Star is about 25.9 degrees N and 97.5 degrees W. Contrary to popular opinion, Polaris is NOT the brightest star. In fact it is very dim and difficult to see from any location in a city. The last star in the handle of the Little Dipper asterism, and the rest of the stars in the

north pie-wedge of sky, appear to slowly rotate with Polaris as the axis [6].

The Big Dipper asterism is low in our horizon and will be hard to see. The W of Cassiopeia will be to the northeast, following Cepheus. If you are old enough to remember the movie *Clash of the Titans* you may know the story of how the family ended up in the sky in lots of trouble [7].

On November 11, 1572 Cassiopeia gave the astronomer Tycho Brahe a wondrous experience—observing a new star, brighter than all the other stars in the sky! Brahe was an experienced excellent mapper of the heavens and was not sure he could believe his eyes. When he called to his friends and assistants, they assured him it was truly a "new star" and the term supernova was coined. It was not the first one, but it was HIS first one. The Crab Nebula was formed by the same kind of explosion that occurred in 1054. Ancient Chinese records detail many observations of wonderful things in the sky. What Brahe saw was the violent death of a massive star [8]. These events happen every few hundred years. Perhaps one night you will be looking up and see one for yourself.

Cassiopeia is the site of M52, M103, NGC 457, NGC 663, and NGC 52. NGC stands for New General Catalog – yes, the stars are actually cataloged. She rests within the Milky Way hosting many hot young stars, losing many massive blue stars which quickly use up their energy and die violent explosive deaths.

Hercules will be low in the west, with Messier Object 13 in his shoulder as he slowly sinks into the western horizon after midnight. The Astronomy Picture of the Day (APOD) will give you a telescope view of this globular cluster of stars [9].

What other wonders are there? Too many to share

here. Go searching online and outdoors and remember to Keep Looking Up! ★

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- [1] *Solar Eclipse Safety*, NASA Solar System Exploration (2022)
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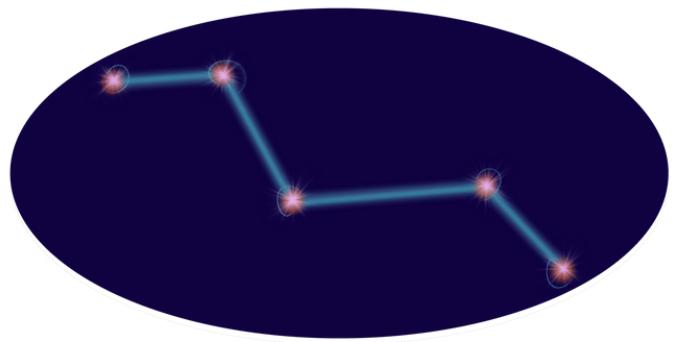
Biography

Carol Lutsinger is the founder of the South Texas Astronomical Society. She spent 40 years as a teacher, serving students from Pre-K through college. Carol attributes her astronomy enthusiasm in part to her experience in the American Astronomical Society's AASTRA program from 1994-96, and her space excitement from serving as a Solar System Educator, and later Ambassador, for the NASA/JPL program. She has been writing the Stargazer newspaper column since 1998, which is carried in the Brownsville Herald and the Valley Morning Star. Retired from formal education since 2020, she still makes every opportunity to share meteorites which she carries in her purse and to ask folks in parking lots if they know what that point of light is.

Vulpecula

"Little Fox"

The fox constellation has no mythological origin, but is still an important (and adorable!) feature in the sky.



K'iin, the Wise Young Man Who Knew the Secrets of the Sun

Carol Lutsinger



Long ago, in a land far south of here, there lived a youth who worked for his living caring for his family's herd of beautiful long-haired goats. He lived with his mother, Mamah, his older sister, Kiik, and his old grandmother, Mamich, in a small house on the edge of a great ancient city in what is now known as the country of Mexico. Everyone had a job to do so that they would have a comfortable way of life. Grandmother Mamich spent her days weaving rugs and blankets from the hair of their goats. Mamah made many colors of dye from the plants that grew in the fields to color the goat hair for the blankets the grandmother wove on her loom. Kiik and K'iin then took the blankets to sell in the market each market day. Thus the family was able to have a comfortable life with plenty of food to eat, clothes to wear and a cozy house in which they lived.

The young man, whose name was K'iin, or Sun, was son, grandson, and great-grandson of men who had long studied the movements of the stars and the guest stars in the night sky, as well as Sol and Loonaa.

His grandmother's hands had carefully woven a colorful goat's hair blanket to record what had been painted on the walls over the hundreds of years of studying the sky. The youth had spent many hours of his childhood watching the grandmother weave at her loom and he listened to her tell the story of the stars as her fingers twisted and wove the colorful threads into the pattern of the blanket.

Because he understood the story in the blanket, he too watched the stars, the Moon, and the Sun as they moved across the sky. He began to learn the secrets hidden in the light of the Sun and he

understood that sometimes the Moon and the Sun were close together in the sky. He thought often about what would happen if the Moon were to pass in front of the Sun some time. He knew that in his great-great-great grandfather's time this had happened and the sky had grown dark at midday! The birds and other creatures had hurried to their nests and dens in fear of that great darkness that covered the sky. K'iin wondered if this would ever happen again. So he studied the blanket and the painted drawings on the cave walls. After a while he realized that an eclipse of the Sun was going to happen in the coming year. This was an exciting idea! Do you wonder why?

Well, when K'iin's sister Kiik had many rugs and blankets to sell at the market, he would go along to drive the donkey that carried the load of blankets and rugs to the marketplace. On market days the king's daughter, the princess Hats'utzil, would often come shopping for a new ring or a new blanket. Whenever the princess saw K'iin she smiled a special smile that let him know that she saw him and approved of the way he helped his family. K'iin felt that there was no other woman in the country that he could love except the princess Hats'utzil.

"Ah," thought K'iin to himself. "Perhaps I have found a way to convince the king that I am a suitable man to marry his daughter!" K'iin hurried home to study the blanket of star lore created by his grandmother from the work painted on the cave walls by his ancestors who watched the sky.

Every the next morning K'iin bathed in the stream in the mountains where the goats were grazing. He put on his best pants and the shirt that his grandmother

K'iin, the Wise Young Man Who Knew the Secrets of the Sun

had decorated with many beautiful designs. He put on his leather sandals and his wide hat. Then he walked straight down the path, through the village, right up to the front gates of the palace of the king, leading the donkey with some of his grandmother's beautiful blankets loaded on its back.

In front of the palace K'iin called out in a certain voice, "Come; see my blankets, the finest ever woven, that I bring as a wedding gift for the lovely princess Hats'utzil!"

The guards at the palace could hardly believe their ears and eyes! The peasant saying he was bringing a wedding gift for the princess? What sort of foolish young man was this? They began to laugh.

High in her window, Hats'utzil heard what the young man said. She recognized him as the young man upon whom she smiled each time she visited the market. Her heart began to beat just a little bit faster. This was exciting; but she knew her father would not agree to give his darling daughter Hats'utzil in marriage to a goat herder! She would only be wed to a wise man who had great power.

The king himself heard the commotion at the gate and commanded that the young man be brought before him at once. The guards led K'iin in to see the king. K'iin bowed low before the king and repeated what he had said outside. "I bring gifts for the lovely princess Hats'utzil who will become my bride before the year is passed."

At this bold statement from a young man with no wealth, the king became furiously angry. "How dare you make such a statement in front of the people? Who are you to say you are going to marry my daughter? A NOBODY! A goat herder! A son of a son of a son of a goat herder who did nothing but tend goats and watch the sky!"

"Ah, my king. I may be a goat herder, but I also command the Sun. I tell you that if you do not agree to let the princess be my bride that I will command the Sun to grow dark. Then you will see the one who stands before you is truly one far more powerful than you will ever be."

The king just laughed in K'iin's face and told the guards to cast him out the doors of the palace and send him home to repent of his audacity. Which they did, with great pleasure, giving K'iin an extra shove as they sent him out the doors.

Each day for seven days the young man went to offer his precious gifts for the princess who was to be his bride. And for seven days he was sent home in disgrace. On the eighth day, K'iin had a different message. "Hear me, oh king. Today, before the Sun has climbed into the tower of the sky, I will command the Sun to stop shining and you will give me the princess Hats'utzil for my bride. The princess has let me know with her smiles that she is not unwilling to become my wife. It is your pride that stands in the path of true love. I will stand here and you will see who has power."

And slowly, slowly the Sun began to disappear behind a black orb. The air grew cooler. The songbirds flew in confusion back to their nests. The hens and roosters went home to roost. The night hawks called and the owls hooted; people in the village began to scurry home to hide from whatever danger this black orb might mean for them. And the sky grew darker as it seemed that the fearsome dark orb was slowly devouring the Sun.

The king realized that here in K'iin, the son of a son of a son of a goat herder, was truly a man of power and substance. He commanded that the treasurer bring three bags of gold to give to K'iin to stop the Sun from disappearing. But K'iin turned down the

K'iin, the Wise Young Man Who Knew the Secrets of the Sun

offer of gold. "I want the princess for my bride and nothing else will I be willing to accept!"

Princess Hats'utzil came out of the palace alone and walked to stand by K'iin. She took his work-toughened hand in her soft one saying, "Father, I agree to marry this clever and powerful young man. He has shown that he is loyal to his family and steadfast in his goals. He is a worthy young man, fit to serve you as a son-in-law of whom you can be proud."

And so the king embraced the two of them, and the dark orb caused by the Moon passing between the Earth and the Sun slowly passed all the way across in front of the Sun. The owls and night hawks went back to bed, the chickens began to cluck, the roosters began to crow, and the songbirds flew around, busy once again calling their bird calls and building their nests.

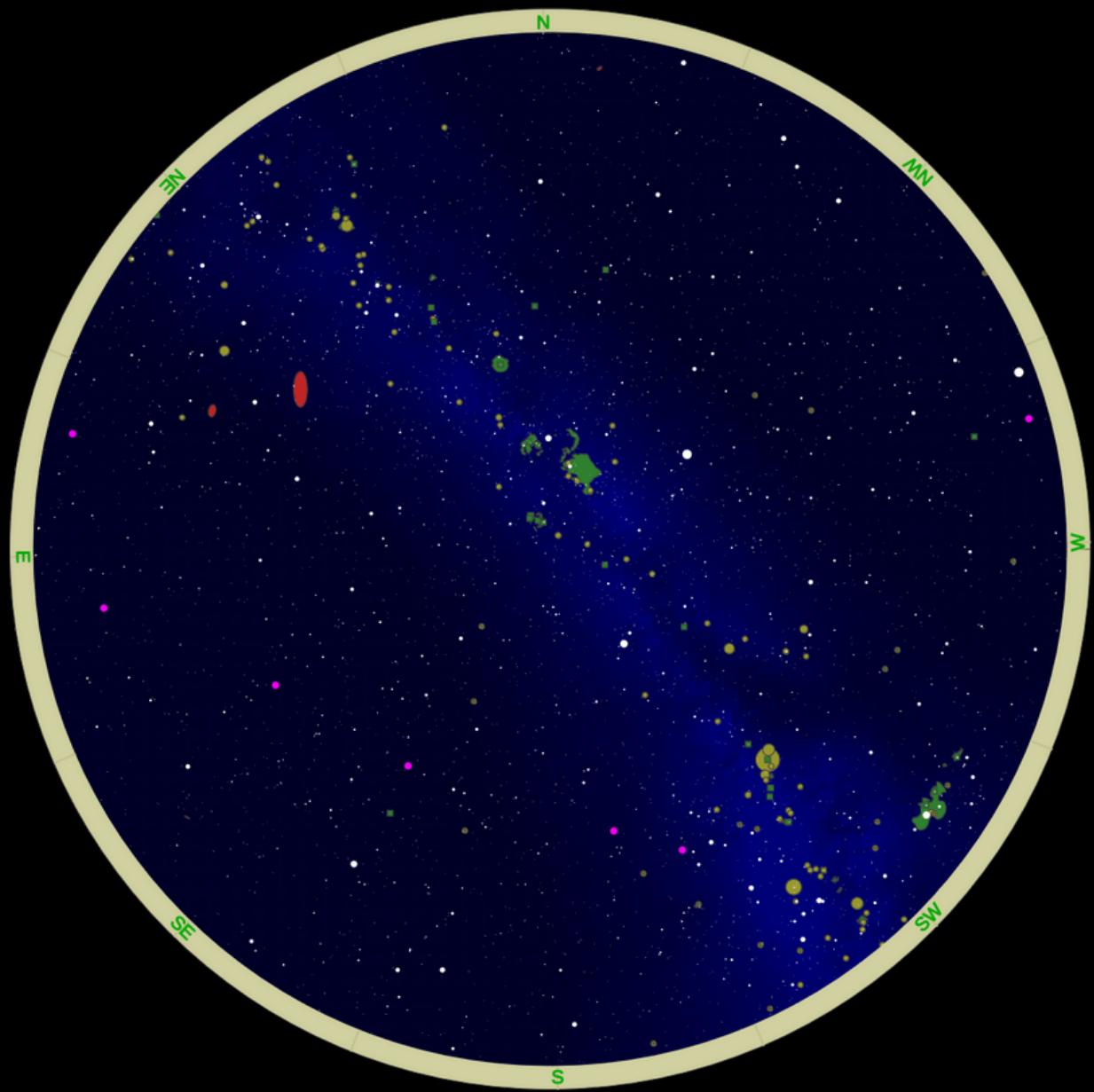
The king made K'iin a Wise Adviser and held a splendid wedding feast and party for K'iin and Hats'utzil. The Wise Adviser and his princess lived happily ever after because K'iin truly had learned from his ancestors a valuable lesson about the stories in the sky and used his knowledge wisely. ★

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Cosmic Coordinates

Fall 2023

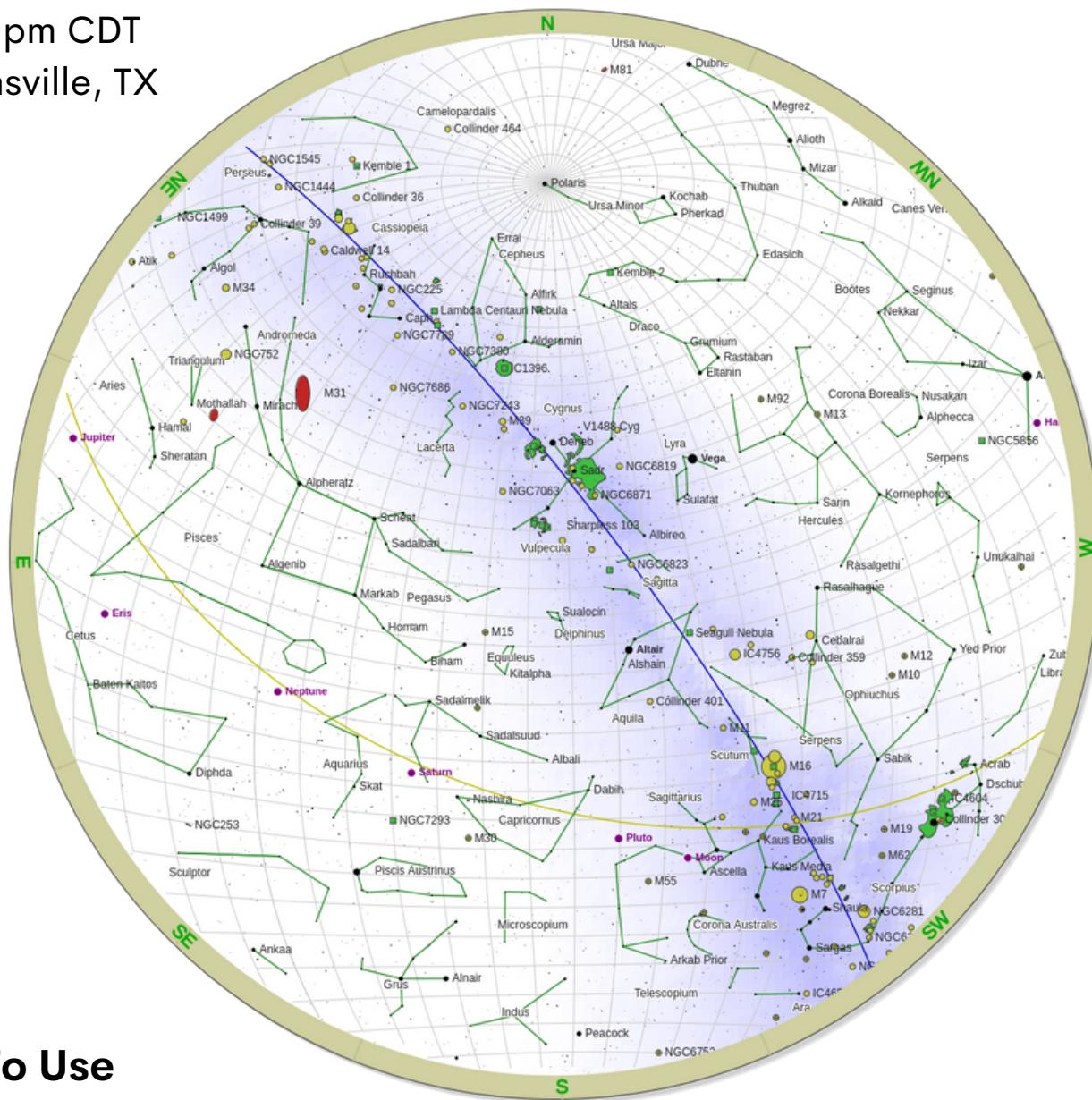


Sky Map

23 September 2023

10:00 pm CDT

Brownsville, TX



How To Use

Here is your own guide for celestial navigation: your very own sky map, allowing you to select and observe the finest of cosmic objects. If you find yourself within the Rio Grande Valley, this map will be accurate to help you along your celestial journey. Good luck, and clear skies! [Credit: Dominic Ford, In-The-Sky.org]

Sky Map Legend

The legend consists of two rows of items. The top row contains three entries: 'The Equator' with a purple line, 'Ecliptic Plane' with a yellow line, and 'Galactic Plane' with a blue line. The bottom row contains four entries: 'Galaxy' with a red circle containing a black dot, 'Bright nebula' with a green square, 'Open cluster' with a yellow circle containing a black dot, and 'Globular cluster' with a yellow circle containing a black dot.

Sky Events

Fall 2023

Appulses

Sep 04, Moon and Jupiter

Sep 05, Moon and M45

Sep 26, Moon and Saturn

Oct 01, Moon and Jupiter

Oct 03, Moon and M45

Oct 10, Moon and Venus

Oct 24, Moon and Saturn

Oct 29, Moon and Jupiter

Oct 30, Moon and M45

Nov 09, Moon and Venus

Nov 20, Moon and Saturn

Nov 25, Moon and Jupiter

Nov 26, Moon and M45

Apsides

Sep 12, C/2023 P1 (Nishimura) at Perigee

Sep 17, C/2023 P1 (Nishimura) at Perihelion

Oct 22, 2P/Encke at Perihelion

Oct 29, C/2023 H2 (Lemmon) at Perihelion

Nov 01, Jupiter at Perigee

Nov 10, C/2023 H2 (Lemmon) at Perigee

Conjunctions

Sep 04, Moon and Jupiter

Sep 06, Mercury at Inferior Solar Conjunction

Sep 13, Moon and Mercury

Sep 16, Moon and Mars

Sep 26, Moon and Saturn

Oct 01, Moon and Jupiter

Oct 02, 136472 Makemake at Solar Conjunction

Oct 10, Moon and Venus

Oct 20, Mercury at Superior Solar Conjunction

Oct 24, Moon and Saturn

Oct 24, 136108 Haumea at Solar Conjunction

Oct 29, Moon and Jupiter

Nov 09, Moon and Venus

Nov 14, Moon and Mercury

Nov 17, Mars at Solar Conjunction

Nov 20, Moon and Saturn

Nov 20, 1 Ceres at Solar Conjunction

Nov 25, Moon and Jupiter

Dichotomies

Sep 22, Mercury

Oct 22, Venus

Earth

Sep 23, September Equinox

Oct 14, Annular Solar Eclipse

Oct 28, Partial Lunar Eclipse

Elongations

Sep 22, Mercury at Greatest Western Elongation

Oct 23, Venus at Greatest Western Elongation

Moon

Sep 06, Last Quarter

Sep 14, New Moon

Sep 22, First Quarter

Sep 29, Full Moon

Oct 06, Last Quarter

Oct 14, New Moon

Oct 21, First Quarter

Oct 28, Full Moon

Nov 05, Last Quarter

Nov 13, New Moon

Sky Events

Nov 20, First Quarter
Nov 27, Full Moon

Occlusions

Sep 19, Neptune

Oct 01, 29 Amphitrite
Oct 18, 136199 Eris

Nov 02, Jupiter
Nov 05, 18 Melpomene
Nov 13, Uranus

Retrogrades

Sep 04, Jupiter Begins Retrograde

Nov 04, Saturn Ends Retrograde

Definitions

Appulse – the minimum apparent separation in the sky of two astronomical objects.

Apsis – the farthest (*apoapsis*) or nearest (*periapsis*) an orbiting body gets to the primary body. Plural is *apsides*. Special terms are used for specific systems: *aphelion* and *perihelion* are used for any object with respect to the Sun; *apogee* and *perigee* are used for any object with respect to the Earth.

Conjunction – when two astronomical objects or spacecraft share the same right ascension or ecliptic longitude as observed from Earth. For superior planets, conjunction occurs when the planet passes behind the Sun (also called *solar conjunction*). For inferior planets, if the planet is passing in front of the Sun, it is called *inferior conjunction*; if behind, it is called *superior conjunction*. Solar conjunctions are the most difficult periods to view a planet with a telescope.

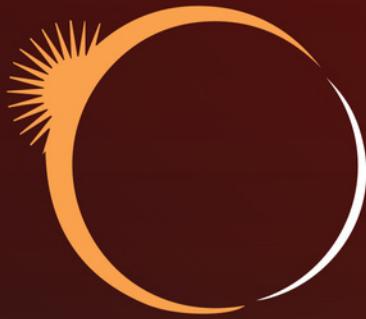
Dichotomy – the phase of the Moon, or an inferior planet, in which half its disk appears illuminated.

Elongation – the angular separation on the sky between a planet and the Sun with respect to the Earth. When an inferior planet is visible in the sky after sunset, it is near its *greatest eastern elongation*. When an inferior planet is visible in the sky before sunrise, it is near its *greatest western elongation*.

Occlusion – when one astronomical object passes in front of the other. An *occultation* is when the foreground object completely blocks the background object. A *transit* is when the background object is not fully concealed by the foreground object. An *eclipse* is any occlusion that casts a shadow onto the observer.

Opposition – when two astronomical objects are on opposite sides of the celestial sphere. Opposition only occurs for superior planets and objects. Solar opposition is the best time to view a planet with a telescope.

Retrograde – when a planet reverses its direction of motion on the sky. A planet entering retrograde motion is an apparent phenomenon caused by the relative motion between the Earth and the object (like a slower car appearing to move backward on a highway as you overtake it).



ANNUAL SOLAR ECLIPSE

OCTOBER 14, 2023

WHEN: SATURDAY, OCTOBER 14, 2023

TIME: 10:00AM - 2:00PM

**WHERE : SOUTHMOST PUBLIC LIBRARY
4320 SOUTHMOST RD, BROWNSVILLE, TX 78521**

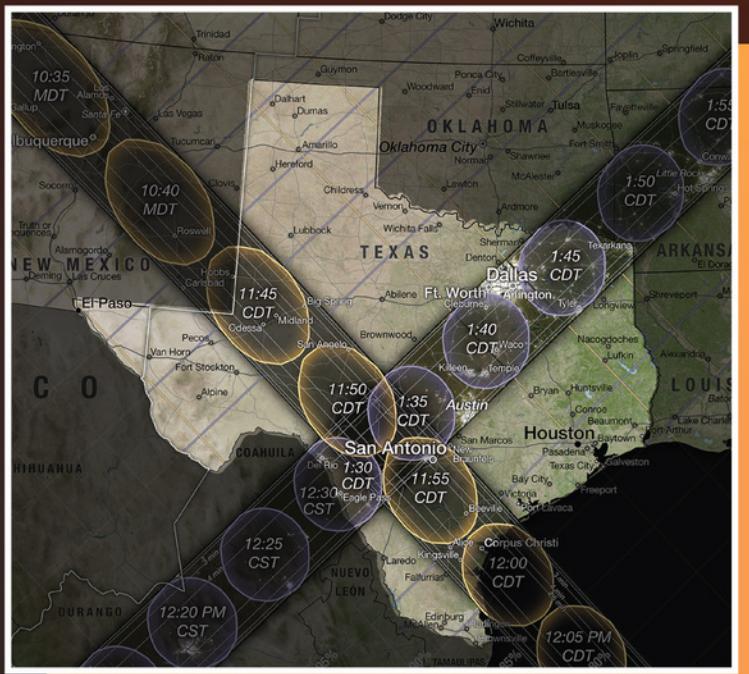
EXPERIENCE THE ECLIPSE

- * Presentations by STARS and NASA Solar System Ambassadors
- * Family-friendly STEM activities
- * Food & drink vendors
- * Eclipse viewing glasses will be available on site while supplies last

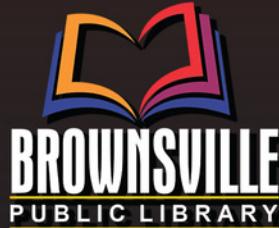
* An annular solar eclipse happens when the Moon passes between the Sun and Earth while it is at its farthest point from Earth.

* Because the Moon is farther away from Earth, it appears smaller than the Sun and does not completely cover the star.

* Observers must wear eye protection at all times while watching an annular eclipse.



For more information on the Annular Solar Eclipse please visit: solarsystem.nasa.gov/eclipses/home



STAR Society
South Texas Astronomical Society

VISIT
Brownsville



Five Lighting Principles for Responsible Outdoor Lighting



Responsible outdoor lighting is

1 Useful

Use light only if it is needed

All light should have a clear purpose. Consider how the use of light will impact the area, including wildlife and their habitats.



2 Targeted

Direct light so it falls only where it is needed

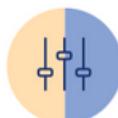
Use shielding and careful aiming to target the direction of the light beam so that it points downward and does not spill beyond where it is needed.



3 Low Level

Light should be no brighter than necessary

Use the lowest light level required. Be mindful of surface conditions, as some surfaces may reflect more light into the night sky than intended.



4 Controlled

Use light only when it is needed

Use controls such as timers or motion detectors to ensure that light is available when it is needed, dimmed when possible, and turned off when not needed.



5 Warm-colored

Use warmer color lights where possible

Limit the amount of shorter wavelength (blue-violet) light to the least amount needed.



Rev. 08-2013

LUZ PARA PROTEGER LA NOCHE

Cinco principios para unas prácticas de iluminación exterior responsable



ÚTIL



TODA ILUMINACIÓN DEBE TENER UN CLARO PROPÓSITO

Antes de instalar o reemplazar una luz, determine si ésta es realmente necesaria. Considere como esta impactará la zona, incluyendo la vida salvaje y el medio ambiente.

DIRIGIDA



LA LUZ DEBE SER DIRIGIDA SOLO DONDE ES NECESARIA

Use apantallamiento y apunte con cuidado para dirigir el haz de luz para que apunte hacia abajo y no se extienda más allá de donde se necesita.

NIVELES DE ILUMINACIÓN BAJOS



LA LUZ NO DEBE SER MÁS BRILLANTE DE LO NECESARIO

Use el nivel de iluminación más bajo requerido. Considere la superficie a iluminar, ya que algunas superficies pueden reflejar más luz hacia el cielo de lo que se pretende.

CONTROLADA



LA LUZ DEBE SER USADA SOLO CUANDO ES ÚTIL

Use controles como temporizadores o sensores de detección de movimiento para asegurar que la luz estará disponible cuando se necesita, atenuada cuando sea posible y apagada cuando no se necesita.

COLOR



USA COLORES CÁLIDOS CUANDO SEA POSIBLE

Limite la cantidad de longitudes de onda cortas (azul-violeta) a la mínima necesaria.

Brownsville to the International Space Station



A Space Station Downlink Event with the South Texas Astronomical Society

On Wednesday, September 6, 2023, students from Brownsville, Texas had the opportunity to get their questions answered by two astronauts aboard the International Space Station during an In-flight Education Downlink event. This amazing event, which was granted to the South Texas Astronomical Society by NASA, presented an amazing experience that helped further our mission to *ignite curiosity* for our students by connecting them with extraordinary individuals who have done what it takes to become NASA astronauts and achieve a goal held by many - getting to space.

The NASA astronauts that we got to connect with were Frank Rubio and Jasmin Moghbeli, both members of Expedition 69 to the International Space Station.



To help maximize the impact of the Space Station Downlink event, STARS partnered with the Brownsville Independent School District (BISD) to host a larger event that included remarkable keynote speakers who were kind enough to travel to Brownsville and inspire our students: former NASA astronaut Colonel Michael Fossum and current NASA engineer Alex Zamora, both sharing their experiences from the Rio Grande Valley to NASA. The event was held at James Pace Early College High School, where STARS helped to establish the student-run Pace Astronomical Society.

More about the astronauts and our speakers:

Frank Rubio:

Francisco Carlos "Frank" Rubio is a US Army lieutenant colonel and helicopter pilot, flight surgeon, and NASA astronaut. He attended the United States Military Academy, and earned a bachelor's degree in international relations. On September 21, 2022, Rubio launched to the International Space Station aboard Soyuz MS-2. His mission was planned to last around 6 months with a return to Earth in early 2023. Damage to the spacecraft extended the mission, however, and before returning to Earth on September 27, 2023, Frank broke the record for longest spaceflight by a US astronaut with 371 days spent in space.

Jasmin Moghbeli:

Jasmin Moghbeli is a US Marine Corps test pilot and NASA astronaut. Jasmin is a graduate of the Massachusetts Institute of Technology, Naval Postgraduate School and Naval Test Pilot School. In 2020, Moghbeli graduated alongside 13 others in the NASA Astronaut Candidate Training Program, officially making her eligible for spaceflight, including assignments to the International Space Station, Artemis missions to the Moon, and ultimately, missions to Mars. On August 25, 2023, Jasmin launched to the International Space Station on a Falcon 9 spacecraft as commander of the SpaceX Crew-7 mission.

Colonel Michael Fossum:

Michael E. Fossum currently serves as a Vice President of Texas A&M University, the Chief Operating Officer of the Galveston Campus, and the Superintendent of the Texas A&M Maritime Academy. Fossum joined Texas A&M following his retirement from NASA Johnson Space Center in

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2017. He is a veteran of three space flights with more than 194 days in space and more than 48 hours in seven spacewalks during his 19 years as an astronaut. During his last mission in 2011, he served as the Commander of the International Space Station. He has logged over 2,000 hours in 35 different aircraft throughout the course of his career.

Alex Zamora:

Alex Zamora is an Intra-Vehicular Activity (IVA) Operations engineer at NASA Johnson Space Center in Houston, Texas. He is certified as an IVA Flight Controller and Crew Instructor supporting the International Space Station and Artemis missions. Alex was born and raised in Brownsville, Texas. He graduated from Hanna High School in 2011 and received his bachelors degree in Electrical Engineering from the University of Texas at San Antonio in 2016. Alex's professional history includes work in the utilities and aerospace industries, enabling humans to live and work on and off Earth.



Following the downlink with the International Space Station and our keynote speakers' presentations, we held a panel-style Q&A discussion with the audience. The theme was *Pathways to Space & STEM*, and the objective of this panel was to cultivate knowledge and curiosity within the students in attendance about the different trajectories they can take to get to their desired career goals.



During the panel, students asked questions and heard stories and life-defining experiences from four distinguished individuals who are all on different parts of their journey:

- Jaqueline Peña - graduate of Pace Early College High School, Ambassador for STARS, and freshman at Stanford University , and current Aerospace Engineering student at Stanford University in California
- Richard Camuccio - current Physics PhD student and researcher at the University of Texas Rio Grande Valley, Assistant Director of the Dr. Cristina Torres Memorial Astronomical Observatory, and Chief Scientist for STARS
- Alex Zamora - Brownsville native now working as an electrical engineer at NASA's Johnson Space Center
- Colonel Michael Fossum - former NASA astronaut and current Chief Operating Officer for Texas A&M University at Galveston

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Space Station Downlink - The Transcript

After a quick soundcheck between NASA's Johnson Space Center in Houston to the International Space Station, the downlink kicked off with opening remarks by our esteemed STARS Ambassador, Jacqueline Peña:

Hello and good morning from all of us here at home, on Earth. Today, we are speaking to you from Brownsville, Texas. My name is Jacqueline Peña and I'm an Ambassador for the South Texas Astronomical Society. Our mission is to ignite curiosity through space science and STEM, and today, we will accomplish exactly that by connecting our students to astronauts aboard the International Space Station and asking a few questions. We would like to thank NASA for giving our community this amazing opportunity, and NASA astronauts Frank Rubio and Jasmin Moghbeli for sharing your time with us today. Now, onto our first question!

Katelyn (Pace High School): From your experience working on the International Space Station, what features would you like to add to future space stations like Gateway?

Frank Rubio: One, we have a pretty awesome station. They did an amazing job engineering this thing and putting it together up here, 250 miles above the surface of the Earth. But, I think I would love to have a window that looks zenith, or above us. So, our beautiful window, or the cupola we have, currently looks down on the Earth, which is pretty awesome because it is probably the most beautiful thing we see up here. But, I think - especially at night - it would be awesome to have a window overhead, where we could just gaze at the stars. That would be one of the main things I would add. I would also add another bathroom, because as we add more and more people up here, It does get a little bit crowded. And, if at all possible, it would be

awesome to add a shower to the ISS. When you're up here for 6 months, or even a year, that's a long time to go without a shower. We do stay very clean, but it would be nice to have running water every once in a while.

Madahlia (Canales Elementary): What do you remember thinking the first time you were on a spacewalk?

Frank Rubio: I'll take that question too, because Jasmin Is gonna do a spacewalk here soon, but she hasn't been on one yet, but I know she's gonna do awesome when she's out there. I'll tell you, the most beautiful thing was the view that you get when you're on a spacewalk. And that's because the windows are pretty cool up here, but, because of the way that we have to protect them, even though you have a 360-view, it's a little bit limited by the structural elements that hold the window panes In place. But when you're on a spacewalk, your helmet has wider view than your peripheral vision, so you feel like you're looking at the Earth and looking at the heavens with just your plain eyes, and it's just magnificent how it all looks. So that was pretty amazing. The other really cool thing that I really enjoyed was just the team that came together to put the spacewalk together - to plan it and put it all together, and put all the products together - hundreds of people pitch in, and then we go out and do probably the most challenging thing that we do, and watching that whole team come together is pretty remarkable.

Paola (Stillman Middle School): Do you think that animals will ever be able to cohabitate alongside humans in space?

Jasmin Moghbeli: So, actually, before we put humans in space, we did put other animals in space. The US flew some monkeys to space, Russia flew some dogs, but now, living here on the Space

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Station, I'm trying to think about my family back home, we usually have dogs as pets and I'm thinking about a dog living up here with us, and I think they might have a hard time - not being able to hang onto the handrails - but I think we can make some provisions for them and adapt a bit, the structure inside here, and I think we could cohabitate with animals.

Jorge (Pace High School): Out of all the mechanical noises in the Space Staton, which is your favorite?

Jasmin Moghbeli: That's a good one. So, I'd have to say something that's hopefully constantly a background noise up here is the ventilation running. So, you know, if we don't have that going, then the air just stagnates and you get pockets of CO₂ and things like that, and so, it becomes a noise that you just become used to and it's kind of like white noise, but it's very noticeable when that sound of the fans goes off and it usually means somethings not quite right, so I'd have to say that's my favorite sound.

Peter (Pullam Elementary): How scary is it to be on a rocket?

Frank Rubio: Well, you know what, it's actually pretty cool - it wasn't very scary at all. The cool thing is that Jasmin came up on a Dragon spacecraft, I came up on a Soyuz, so, two totally different rockets. But I think we both felt the same. The cool thing is that we train for this mission for almost 2 years, and constantly during that time, you're practicing what to do if things go wrong. And so, all you ever do is practice emergencies, time after time after time, because it's really critical that you do the exact right thing if those things were to happen. But, on the day that you launch, everything goes perfectly, so, it's actually pretty chill because nothing's going wrong compared to all the simulations that you've done up to that point. The other thing is that you're so

focused on making sure that all the right things are going on and reading your instruments and making sure that the rocket is healthy that you really don't have a lot of time to think about what's actually going on and how much rocket fuel you're sitting on top of and the fact that you're speeding up from zero to almost 15,000 miles per hour. All that stuff's pretty cool, but the reality is that most of us are pretty focused on what's going on, and it's not until after we get to space that we actually think "wow, that's pretty amazing!"

Victor (Pullam Elementary): Does microgravity affect your perception of time?

Jasmin Moghbeli: So, speaking of time, up here, you know, the International Space Station goes around the Earth 16 times a day - it's traveling 17,500 miles per hour. So, inside, you know, when we're back home on Earth, we use light - the Sun - and the night kind of sets our circadian rhythm and tells our bodies when we should be waking up and going to sleep. Up here, we don't have that because we're going in and out of sunlight every 90 minutes, so, up here we actually kind of use the lights inside the International Space Station. We turn them on bright during the day and dim them or turn them off at night to kind of set our time inside our bodies.

Aldo (Rivera High School): How would you relate your experience in the air Force to that of being an astronaut?

Frank Rubio: Well, both Jasmin and I are in the military, but neither of us are Air Force. Jasmin's a marine, I'm in the army. But all of the military forces provided astronauts to NASA, and they've done so since the beginning of the space program. The cool thing is that when we work for NASA, we really focus on the science and on the outreach for human space exploration. But I think the military does prepare you

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in some really good ways. One is the fact that you're part of a team - a really amazing team - and just like in the army or the marine core, here at NASA, we have amazing people around us that really make the mission happen. And so that's probably the most gratifying thing about it. But the other thing that I think is really important for most of us is that you're contributing to something that's bigger than yourself and you really feel like you have a purpose, which for us here is to say "hey, we can send humans to space, we've been up here for 23 years, and soon we're gonna be going back to the moon and eventually over to Mars, and we know that everything that we do here is contributing to that long-term mission." And so that's a pretty cool sense of satisfaction, to know that we're contributing to something that's bigger than ourselves.

Jorge (Stell Middle School): Are there any specific songs or albums that hold a special meaning for you in relation to your astronaut career?

Jasmin Moghbeli: So, It's funny, when I think back to my time in the military, each deployment is defined by the songs I listened to on it, and when I hear certain songs it takes me back to those deployments. Up here, I've only been up here a week, so, you know, I don't have a whole album or anything specific. But actually, I was working out the other day - and Frank's probably gonna laugh at me for this one - but the song *A Whole New World* came on, from Aladdin. I don't know If you're old enough to have seen Aladdin, but, you know, my name's Jasmin, like Princess Jasmin, so when I was in elementary school and Aladdin came out, people would always sing *A Whole New World* to me, and I thought the words were fitting. One, in Aladdin, when that song is being sung, they're on a magic carpet, flying around, and here in space, I love floating through the different modules and I feel kind of like a superhero flying around. And then second,

just the words, "a whole new world", and from up here, looking back on Earth, it's totally changed my perspective and it does feel like a whole new world. So, I'd have to say that song was one that really stuck out to me when I was working out the other day and I've listened to it a few times since then.

Andrea (Porter High School): What experiments are conducted on the International Space Station to learn more about living in space?

Frank Rubio: Well, I'm still singing *A Whole New World* in my head, so... You know, like I said, one of the key things that we do up here as astronauts is see how humans respond to space. So a lot of the science focuses on us. We're doing simple things, like how does eating a different type of diet affect your performance in space? We also do a lot of medical procedures like ultrasounds of our eyes, and our different blood vessels because we want to see how living up here in space for six to twelve months affects those systems. But then, we also do some really cool things on things like combustion. So, in space, without gravity, you also don't have the movement of more dense and less dense particles as they heat up, right? So, convection that happens on Earth doesn't really happen here in space, and that's really important for things like fuel, and especially rocket fuel, because we want those things to work up here. So we study things like that and we see how combustion happens. If you light a candle in space, it actually doesn't form that little tip, because - again - there's no convection happening, and so it actually forms a little sphere. We don't get to light candles because it's a fire hazard, but we've seen videos of some of the science experiments that happen up here. So all those things will help us to not just live on the Space Station, but live eventually over on the moon and on Mars, which will be pretty cool.

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Layne (Burns Elementary): How often do you do math on the International Space Station?

Jasmin Moghbeli: So, you're probably wondering If the math is really worth it. So, actually, every day, not necessarily sitting down with a pencil and paper doing math, but even just getting around the Space Station, you know, if I want to go a certain direction, I have to put that force through my center of gravity to go that way, and then – oh no, I grabbed on here, but my center of gravity is offset – so I rotate. And so, every single time we're just moving around the Space Station, we're using math and physics to figure out how we should input a movement or translational force. The other day, I had to move a big object through the Space Station – I had to think about not just my center of gravity, but now me and this big object, and that center of gravity. So, I think we're kind of constantly doing math up here, and sometimes for the different experiments we need to use those skills as well. So, it's basically a daily thing.

Viviana (Pace High School): In your opinion and experience, how important is it to see diverse representation lead the frontier of space exploration?

Frank Rubio: Well, I think it's really important, but I think it's equally as important to pick the most qualified people out there. And that's because this is a really tough mission, and so you want to make sure everyone that does this mission is incredibly capable and able to handle it. But the cool thing is – I don't really like to talk about accomplishments because I don't want to sound boastful – but in this case, Jasmin graduated from MIT, she's a Cobra pilot, she's a marine test pilot. Like I said, I've been in the army for 20+ years, I started off as a Black Hawk pilot, I then became a medical doctor, and I've worked with Special Forces and lots of other things. But the cool thing is – the reality is – if you pick the

most qualified people now in our country, you're gonna have great gender representation, you're gonna have great representation from different ethnic backgrounds, and we're gonna look like America, cause a lot of highly qualified people are out there. So, hopefully you guys will keep hitting the books, and someday we're gonna be sitting there looking at you guys and thinking "wow, they are so incredible qualified and way more qualified than we were ever." So, we look forward to seeing what your generation has to offer.

Santiago (Pace High School): How would you explain the International Space Station's protection from radiation to a 5th grader?

Jasmin Moghbeli: So, in terms of the International Space Station and our protection from radiation, there are many different types of radiation. Thankfully, we're in low-Earth orbit, so we're still inside the Van Allen belt, so the Earth's magnetic field protects us from a lot of the radiation. We also have the structure of the Space Station around us, and if there are times, you know, when we track a specific event coming, like a solar high activity, solar flare event, we can also use additional things like water. We regenerate a lot of our own water, so that's a resource we can use to create additional barriers to help protect us. Obviously, once we start going further in the Solar System and past the Van Allen belt, we'll have to consider more things to protect us from radiation and that's why a lot of the missions that go up – for example, Artemis I – had some mannequins on it that were carrying sensors in the torso to detect a lot of the radiation, so that we can be prepared for those missions as we go further.

Madahlia (Canales Elementary): What happens if someone gets sick on the Space Station?

Frank Rubio: Jasmin's tapping my shoulder, because

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as a doctor, I'm currently acting as the Chief Medical Officer. But there's not always a doctor on board, so we all go through medical training – including Jasmin – so if I were to get sick, she would be taking care of me. And so, we all get a basic amount of medical training. But the best thing is that we all stay pretty healthy. We all stay in pretty good shape, and so that helps us really not get sick up here. The other thing we do is we use quarantine, which now, after COVID, we're all familiar with. But we've been doing that since humans have been living in space – we basically spend two weeks before our launch isolated from other people, and that's because we don't want to bring any new viruses or be sick when we fly up here. And generally, you're only exposed to six other humans while you're on the Station, so there's not a whole lot of viruses up here to get you sick. The one thing that can throw you off, though – as Jasmin said – is your vestibular system. So, you can get a little sick the first few days you get here. And if you think about it, if I jump up here, [Frank floats to "stand" on the side wall of the Station] if I did this on Earth and I started standing like this, my brain would really just not be able to handle it. And so the first couple days that you're up here and you're doing that a lot, it really throws you off and a lot of people get nauseous and some people throw up. But we have medicine for all that, and within a few days you adapt and then it feels perfectly normal.

Katelyn (Pace High School): Can you describe your most awe-inspiring or memorable moment during your time in space?

Jasmin Moghbeli: That's a great question. You know, this is my first week in space, so a lot of things that are coming to mind, so I'll mention two. The first one I'll mention is when we first got to the Space Station, you know, it seemed very busy at first and a bit disorienting as Frank described – I was looking

at things from a totally different perspective than I had before. After training hundreds of hours in these modules, couldn't even tell where I was because now the ceiling was the floor and vice versa. But Andy finally pulled me over – you know, he's done a mission to the Space Station before, and he was like "have you gone to the cupola yet?" And I was like "no, I haven't," and he took me to the cupola, which is our Earth-facing window, and he opened the shutters, and you know, it was just an amazing view. Not just of Earth and our beautiful planet, but also seeing the International Space Station and it's just such a marvel, this thing we've constructed in space. And then the second one I'll say is right after second engine cutoff, you know, you're suddenly in weightlessness, and I felt like I was just handing upside-down from my restraints. And so at first, I was like "okay, this just feels a little uncomfortable, actually," and then, finally, it was time for us to get out of our seats and I unbuckled, and that was my first experience of floating, and that was just incredible, and I also broke out some of my candy-coated peanuts. Frank, would you like some?



[Jasmin launches one of her candy-coated peanuts towards Frank, demonstrating how objects float in the Space Station's low-gravity environment. He catches it with his mouth, and they both high-five.]

Frank Rubio: And almost every day, we get to play with our food, which is one of the cool things about being an astronaut.

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And with that inspiring tossing of candy, our wonderful conversation with Frank Rubio and Jasmin Moghbeli slowly began coming to an end.

The downlink concluded with closing remarks from Colonel Michael Fossum:

Howdy! My name's Colonel Mike Fossum. I'm a retired astronaut now, but I spent 194 days in space during my three missions to the International Space Station. This brings back a lot of memories. I really want to thank NASA and the astronauts on board the Space Station today for bringing this opportunity to the Valley through the South Texas Astronomical Society. I grew up in McAllen, down by the border, just like the rest of you. I dreamed about flying in space when I watched Apollo 11 put the first footprints on the moon. People laughed; people said I was crazy. Part of me gave up on even believing the dream was possible, but I never completely gave up. I had teachers and friends and family who believed in me and supported me - supported me to go to college, and through the opportunities beyond - continuing to lean forward until it finally came true. I pray that you will believe in your dreams, and you will reach every day towards striving to achieve those dreams. If you believe it and if you're willing to work hard enough for it every single day, you can do amazing things. Thanks again for a great day.

And some final words from Frank Rubio:

Thanks so much, Mike, and thank you all to the members of STARS. Keep studying, and keep working towards your dreams. Take care!

The South Texas Astronomical Society has hosted many programs over the past few years, but this Space Station Downlink was a unique experience for everyone involved. Since our designation as a *NASA Informal Education Community Anchor* in 2021, our partnership with NASA has flourished, and they continue to provide us with incredible opportunities for the community we serve.

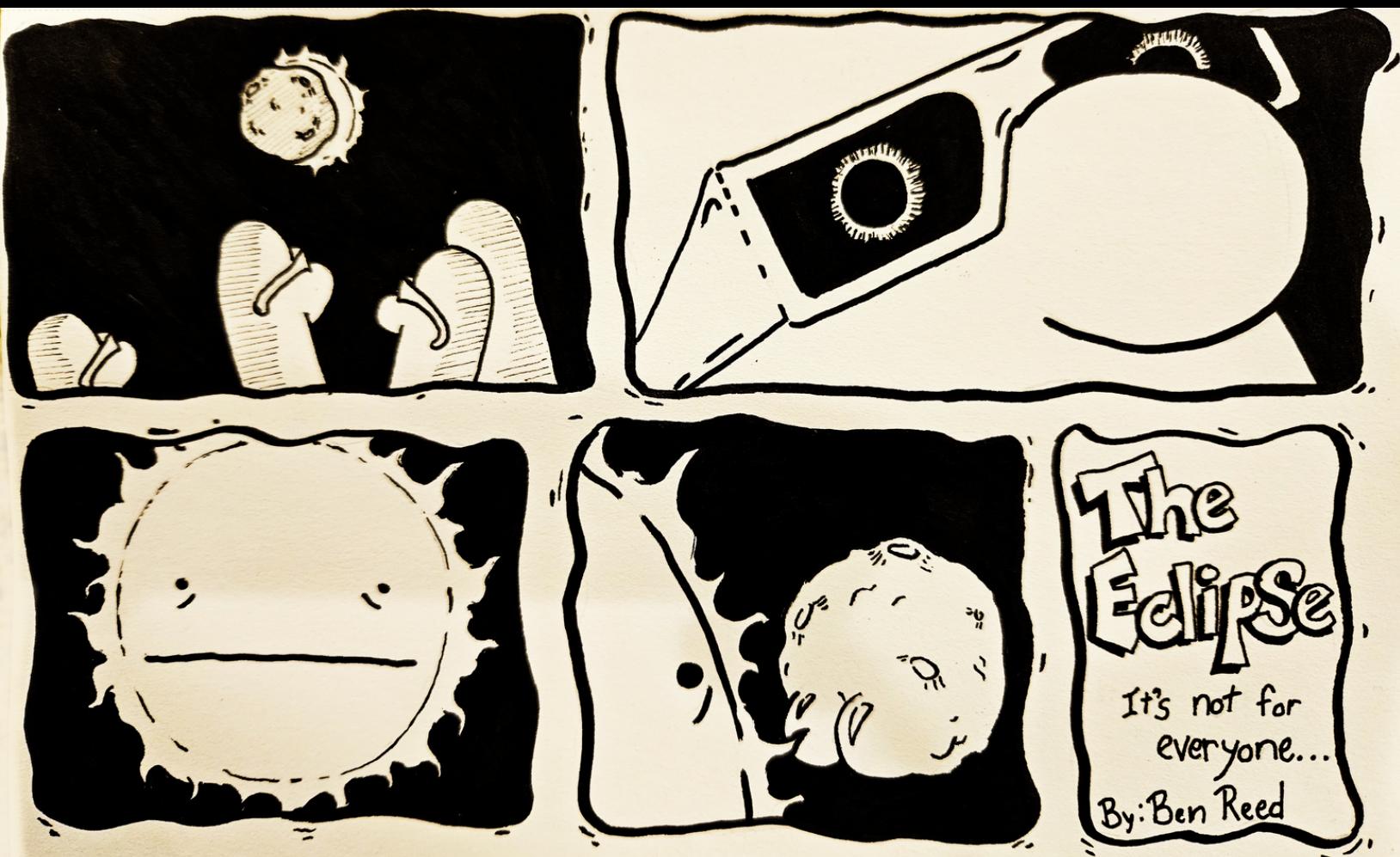


Before leaving the event, everyone took part in a group selfie with Colonel Mike Fossum, resembling his famous "selfie" taken a spacewalk, where Earth is beautifully reflected on his helmet.



The Downlink video is available on NASA's YouTube channel at: https://youtu.be/bpP4cfsNAsw?si=Yn4m_ntTntvHWVEC

And the entire Downlink event, including all presentations, is available at on BISD's channel at: <https://youtu.be/G8J1IK3E0Rg?si=b1aM2fHjkUqcvGEh>



Art by Ben Reed

Space Rangers

Fall 2023

🚀 **Welcome Space Rangers!** 🚀

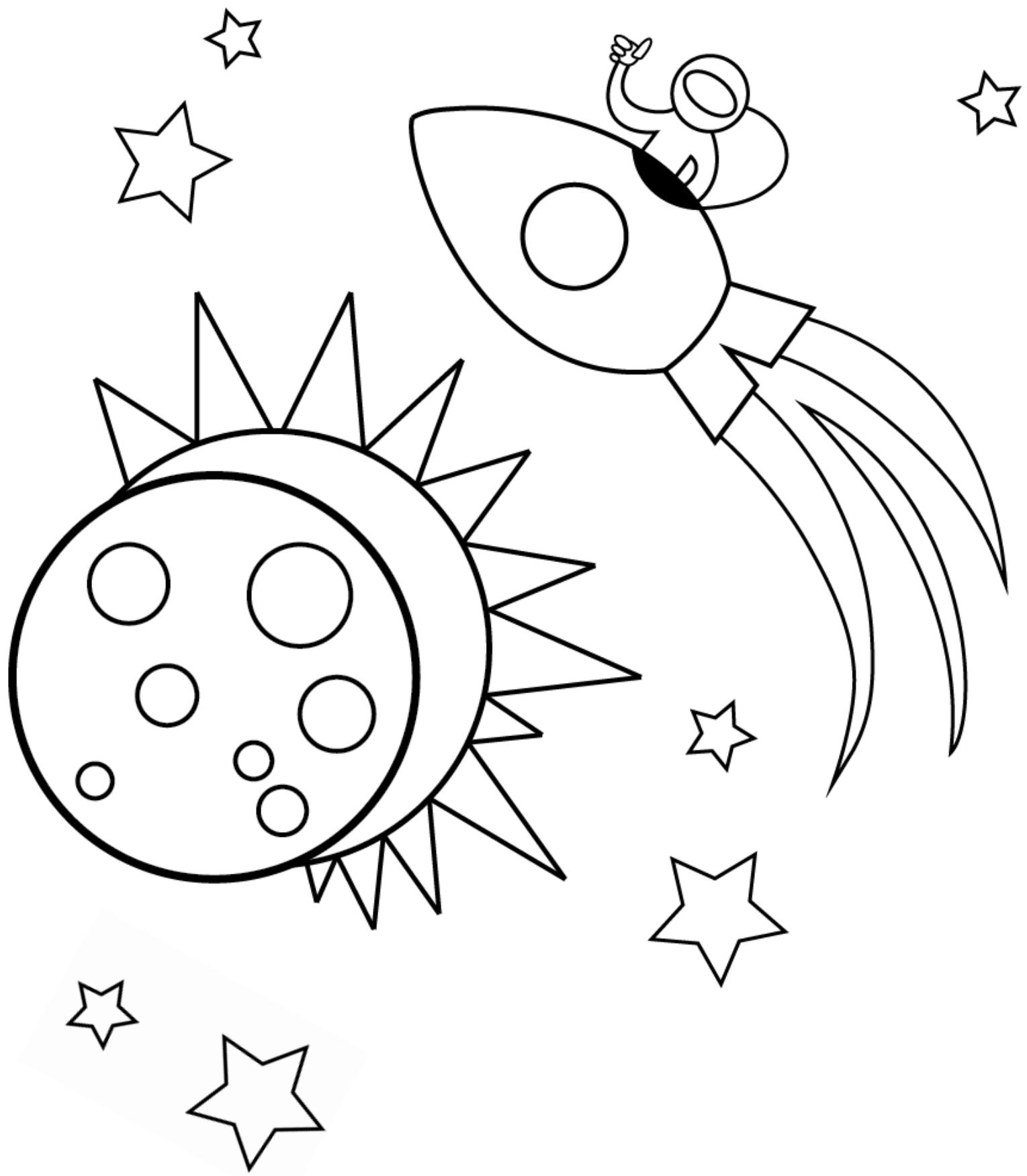
Time to use your creative skills and put them to the test!
We hope you enjoy our featured coloring page, word
search, some fantastic eclipse artwork!

Your adventure awaits!

Exciting contents include:

1. Coloring
2. Word Scramble
3. Word Search
4. Crossword Puzzle
5. Artwork





Space Rangers Word Scramble

1. YORTAOMNS	Universe and everything in it
2. TSELCAELI	Pertaining to the sky
3. NACROO	Outermost part of the Sun's atmosphere
4. PECLIES	When the Moon blocks the light of the Sun from reaching Earth
5. ITLGH	A form of energy that moves in straight lines
6. OMNO	Earth's only natural satellite – a celestial body that orbits a planet.
7. TPHA	A route
8. TARS	A luminous ball of gas
9. SETOLECEP	An instrument that allows people to see distant objects
10. IYLOTTAT	A combined amount

(1) ASTRONOMY, (2) CELESTIAL, (3) CORONA, (4) ECLIPSE, (5) LIGHT, (6) MOON, (7) PATH, (8) STAR, (9) TELESCOPE, (10) TOTALITY

Space Rangers Word Search

S	Y	R	Y	T	E	F	A	S	E	Y	E
O	A	N	N	U	L	A	R	Y	Q	R	A
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U	P	M	O	G	O	Y	C	L	E	P	L
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Space Rangers Word Search

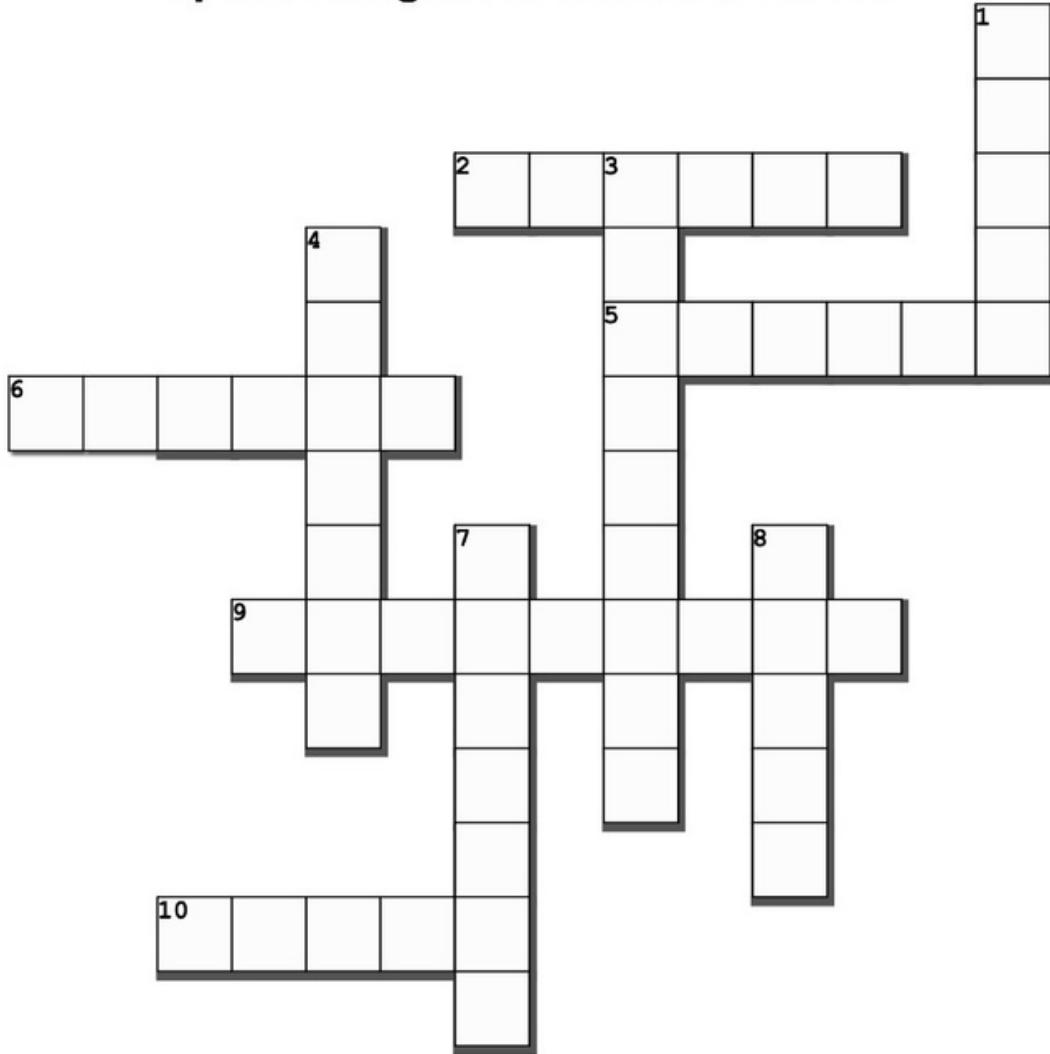
Solutions

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- (1) ANNULAR, (2) CHROMOSPHERE, (3) CORONA, (4) ECLIPSE, (5) EYE SAFETY, (6) LUNAR, (7) PENUMBRA, (8) SAROS CYCLE, (9) SOLAR, (10) SYZYGY, (11) TOTALITY

Learn the meaning of these eclipse-related terms and more at: TheSunToday.org

Space Rangers Crossword Puzzle



Across

2. A vast system of stars, gas, dust, and other celestial objects held together by gravitational forces.
5. A small celestial object that enters the Earth's atmosphere and burns up upon entry, creating a streak of light.
6. NASA program that sent astronauts to the moon. Also, the name of a Greek god.
9. A special kind of scientist that takes a spaceship to outer space
10. The path that one object takes around another object in space.

Down

1. Refers to anything related to the sun.
3. The brightness or intensity of light emitted or reflected by an object.
4. When the moon passes between the Earth and the sun, temporarily blocking the sunlight.
7. The force that attracts objects with mass towards each other.
8. Anything related to the moon.

Space Rangers Crossword Puzzle



Across

2. A vast system of stars, gas, dust, and other celestial objects held together by gravitational forces. (**galaxy**)
5. A small celestial object that enters the Earth's atmosphere and burns up upon entry, creating a streak of light. (**meteor**)
6. NASA program that sent astronauts to the moon. Also, the name of a Greek god. (**apollo**)
9. A special kind of scientist that takes a spaceship to outer space (**astronaut**)
10. The path that one object takes around another object in space. (**orbit**)

Down

1. Refers to anything related to the sun. (**solar**)
3. The brightness or intensity of light emitted or reflected by an object. (**luminance**)
4. When the moon passes between the Earth and the sun, temporarily blocking the sunlight. (**eclipse**)
7. The force that attracts objects with mass towards each other. (**gravity**)
8. Anything related to the moon. (**lunar**)



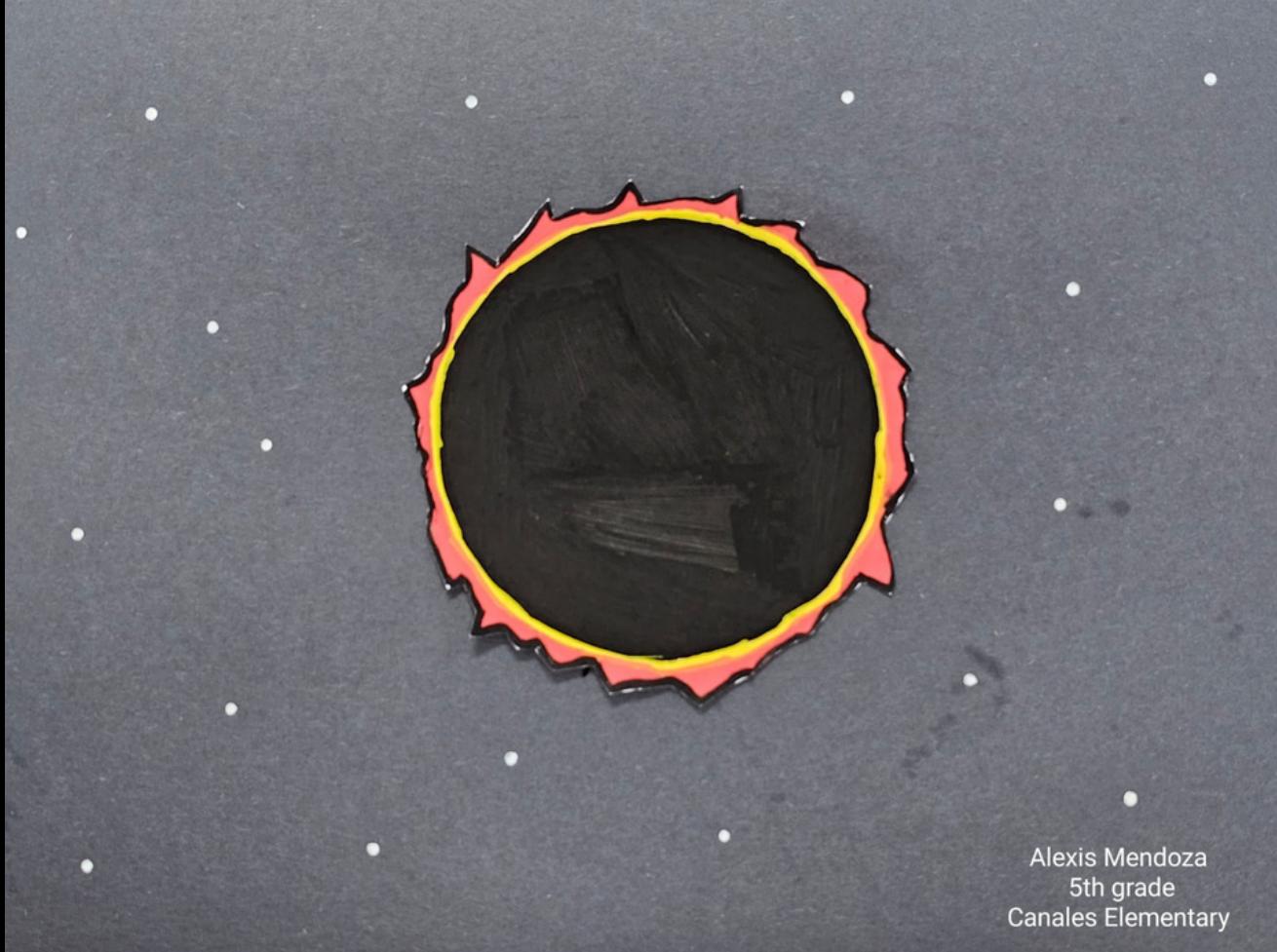
Iris Suarez
5th grade
Canales Elementary



Megan Andrade
5th grade
Canales Elementary



David Martinez
Mechanical
Engineering
student at UTRGV



Alexis Mendoza
5th grade
Canales Elementary



Michelle Martinez
5th grade
Canales Elementary

Colophon

Contributors

Alexis Mendoza
Benjamin Reed
Carol Lutsinger
David Martinez
Deborah Camuccio
Iris Suarez
Lucero Martinez
Megan Andrade
Michelle Martinez
Victor De Los Santos

Art Director

Gabrielle Camuccio

Spanish & Assistant Editor

Ximena Guajardo

Editor-in-Chief

Richard Camuccio

Website

www.starsocietyrgv.org

Submissions

We encourage submissions from anyone interested in contributing to our newsletter. Any readers with ideas for our newsletter, or who are interested in submitting their own articles, illustrations, or other content, please contact the Editor-in-Chief at: richard.camuccio01@utrgv.edu



The South Texas Astronomical Society (STARS) is a nonprofit organization connecting the Rio Grande Valley community to space and science.

Our Mission is to ignite curiosity in the RGV through space science education, outreach programs, and by serving as a liaison between community members and space organizations and resources.

Our Vision is that STARS nurtures the innate human desire for exploration and discovery by fostering connections to science and the cosmos across the RGV.

FarFarOut! - Shadows of the Ecliptic
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