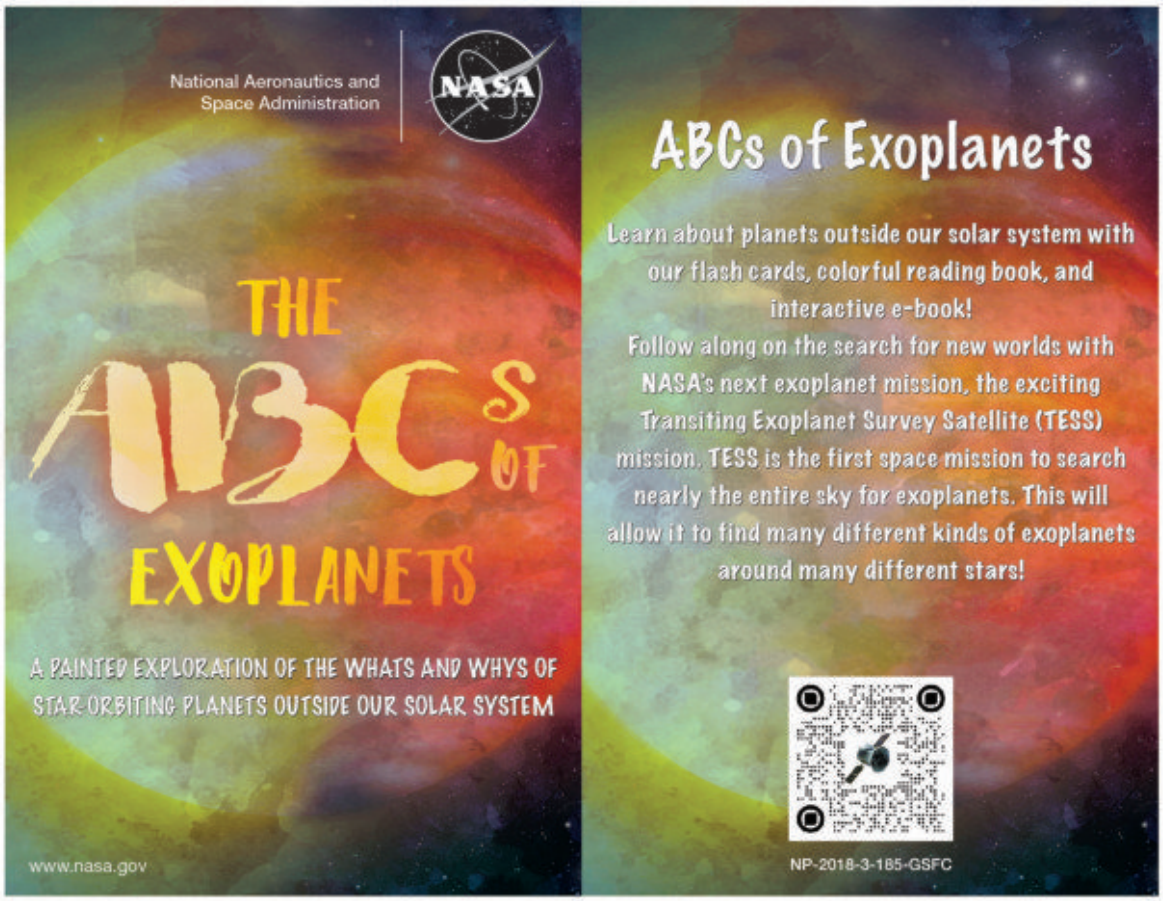
National Aeronautics and
Space Administration

ABCs of Exoplanets Flash Card Downloads



Directions:

Print each page on 8.5x11 inch sheet of paper (regular or cardstock). After printing each sheet, cut the flash cards out (dotted lines only provided for light colored cards). Fold each card in half after cutting them out. Tape or glue the two halves together to create finished flash cards. You will end up with a stack of 28 flash cards total when you are finished.

National Aeronautics and Space Administration

NASA

THE ABCs OF EXOPLANETS

A PAINTED EXPLORATION OF THE WHATS AND WHYS OF STAR-ORBITING PLANETS OUTSIDE OUR SOLAR SYSTEM

www.nasa.gov

ABCs of Exoplanets

Learn about planets outside our solar system with our flash cards, colorful reading book, and interactive e-book!

Follow along on the search for new worlds with NASA's next exoplanet mission, the exciting Transiting Exoplanet Survey Satellite (TESS) mission. TESS is the first space mission to search nearly the entire sky for exoplanets. This will allow it to find many different kinds of exoplanets around many different stars!

NP-2018-3-185-GSFC

ASTRONOMY

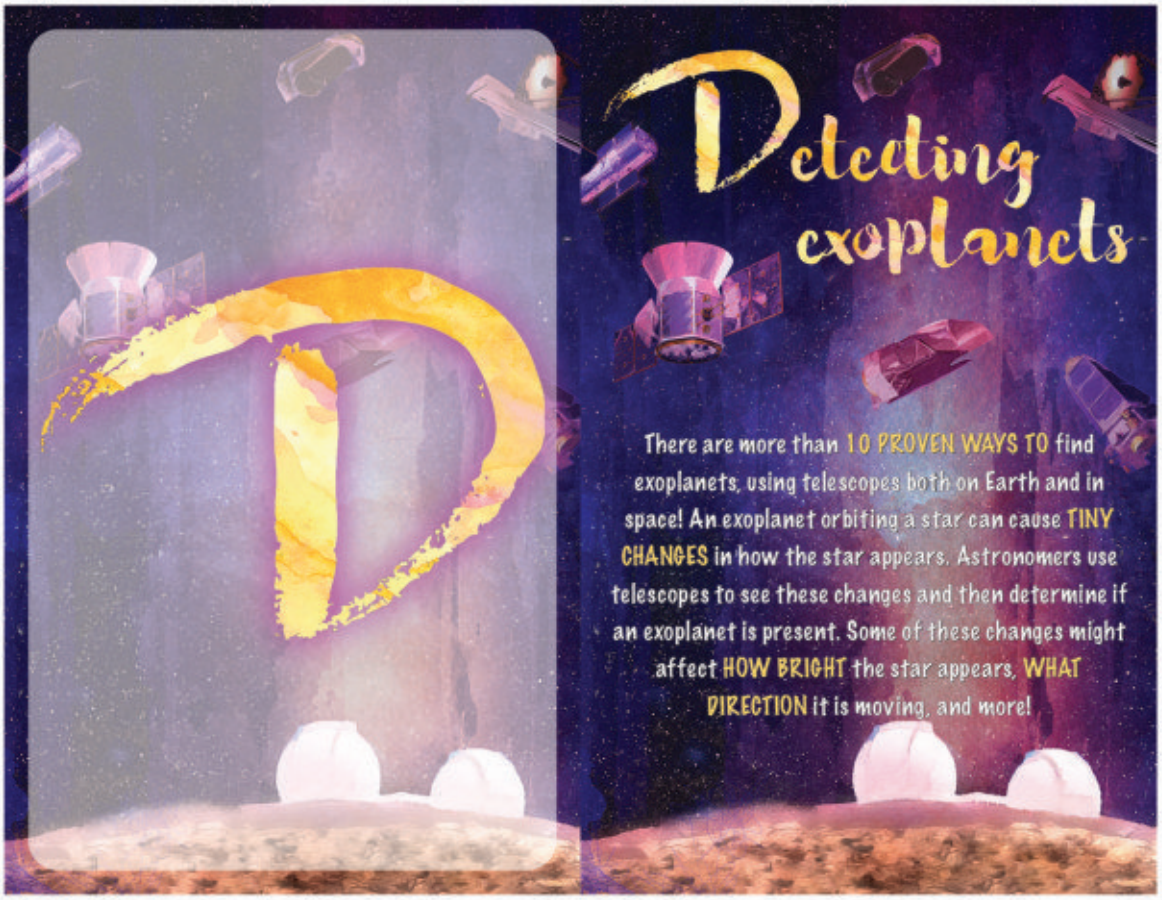
There are MANY FIELDS of science to study our world and the rest of the of the universe.

ASTRONOMY is dedicated to studying the OBJECTS and SPACE that are outside our planet.

SCIENTISTS who explore, study, learn, and teach others about our UNIVERSE and its many objects are called ASTRONOMERS.


B
B
INARY STAR SYSTEM
A binary star system is a GROUP OF TWO STARS that orbit each other or the same central point. Astronomers believe at least HALF OF THE STARS in our galaxy are part of BINARY SYSTEMS! An exoplanet orbiting a binary star system could have MULTIPLE SUNRISES and SUNSETS!


C
Composition
When an exoplanet is discovered, one of the first things astronomers want to know is its composition, or the combination of elements that make up the planet.
Is the exoplanet a water world?
Or is it a gas giant?
Perhaps it is a rocky world!
exoplanet
Is the exoplanet rocky or gassy? Perhaps it is a water world! COMPOSITION can help astronomers determine whether an exoplanet could be HABITABLE.


D
Detecting exoplanets
There are more than 10 PROVEN WAYS TO find exoplanets, using telescopes both on Earth and in space! An exoplanet orbiting a star can cause TINY CHANGES in how the star appears. Astronomers use telescopes to see these changes and then determine if an exoplanet is present. Some of these changes might affect HOW BRIGHT the star appears, WHAT DIRECTION it is moving, and more!

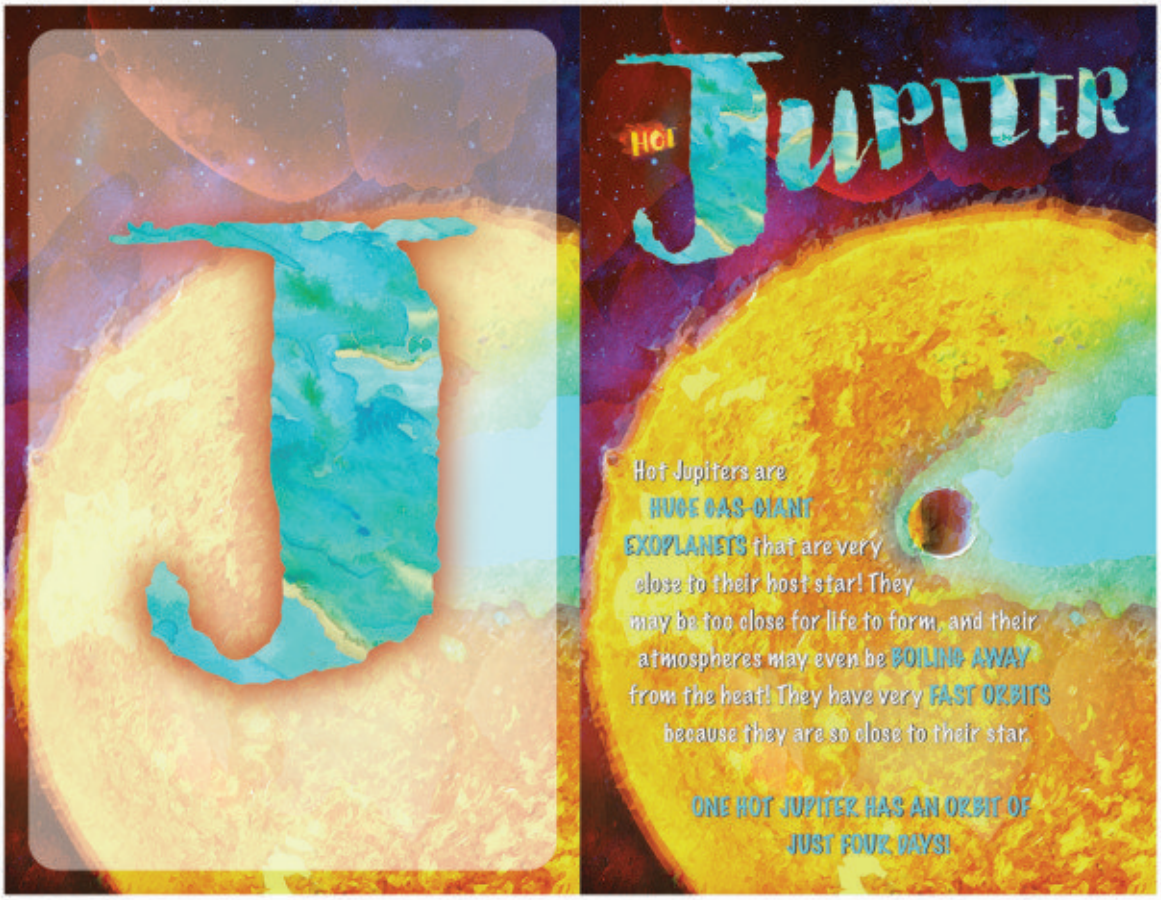

E
Exoplanets
On a clear dark night, you can see THOUSANDS OF STARS in the night sky. Each of those stars may have planets orbiting it, called EXOPLANETS! Exoplanets do not belong to our solar system. Some may be similar to our solar system's planets, but some may be VERY DIFFERENT.


F
Free Floating Planet
Not every EXOPLANET can be bound to orbiting a STAR. If an exoplanet is ejected from its star system, that planet FLOATS FREELY in space; these exoplanets are also sometimes called ROGUE PLANETS! Scientists estimate there could be hundreds of billions of FREE-FLOATING planets in the Milky Way.


G
GAS GIANTS
GAS GIANTS are huge planets that are made mostly of gases and do not have a surface made of rocky materials and metals. These planets are MUCH LARGER than rocky worlds like our Earth. We have four gas giants in our solar system!


H
Host Star
Exoplanets orbit their own SPECIAL STAR, called a host star. Host stars can come in all different colors, sizes and temperatures. Sometimes EXOPLANETS even orbit around more than one star in a system! HOW FAR AWAY an exoplanet is from its HOST STAR helps determine whether the exoplanet can be HABITABLE.


I
Infinite WORLDS
THERE ARE MANY, MANY GALAXIES in our universe. In each galaxy, stars are forming ALL THE TIME! Planets could be forming around these new stars, too! With so many stars to study and observe, the number of exoplanets is ENDLESS!

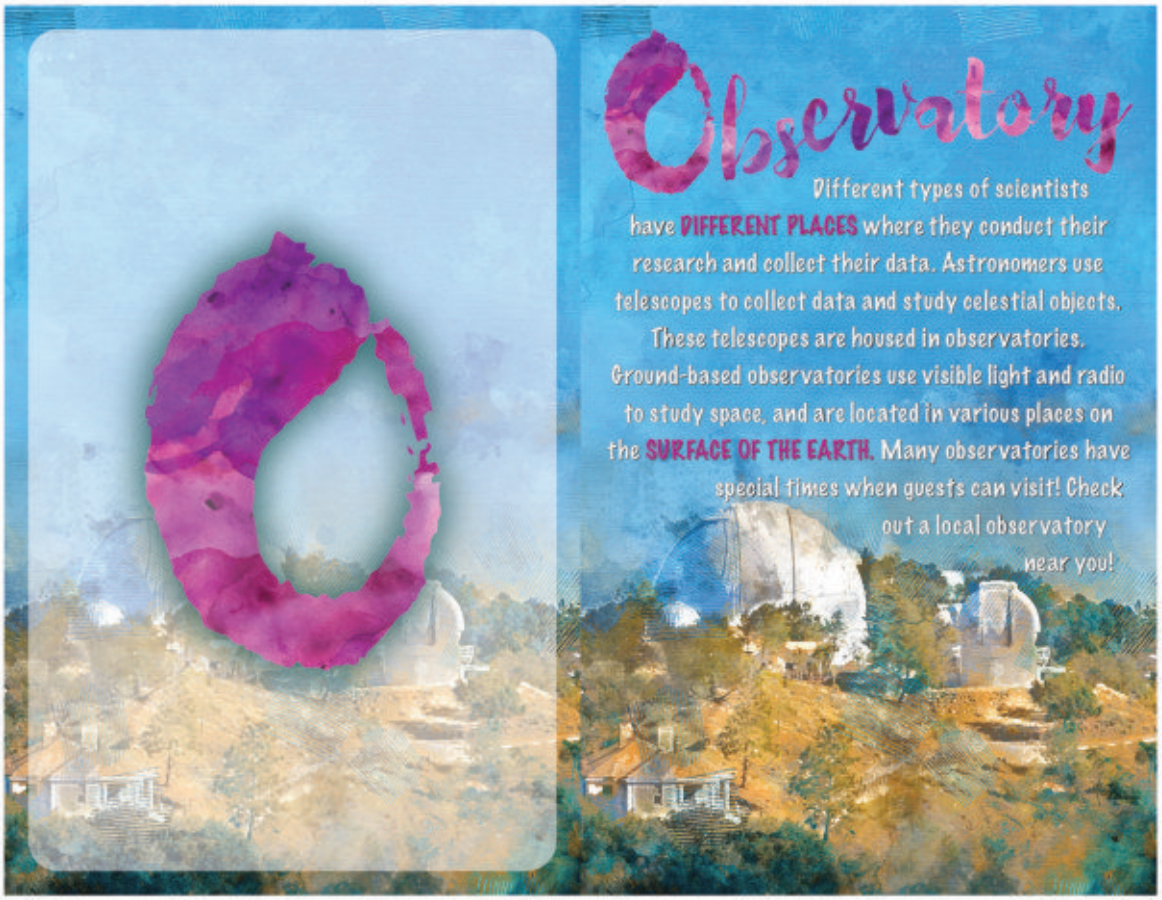

J
HOT JUPITER
Hot Jupiters are HUGE GAS-GIANT EXOPLANETS that are very close to their host star! They may be too close for life to form, and their atmospheres may even be BOILING AWAY from the heat! They have very FAST ORBITS because they are so close to their star.
ONE HOT JUPITER HAS AN ORBIT OF JUST FOUR DAYS!

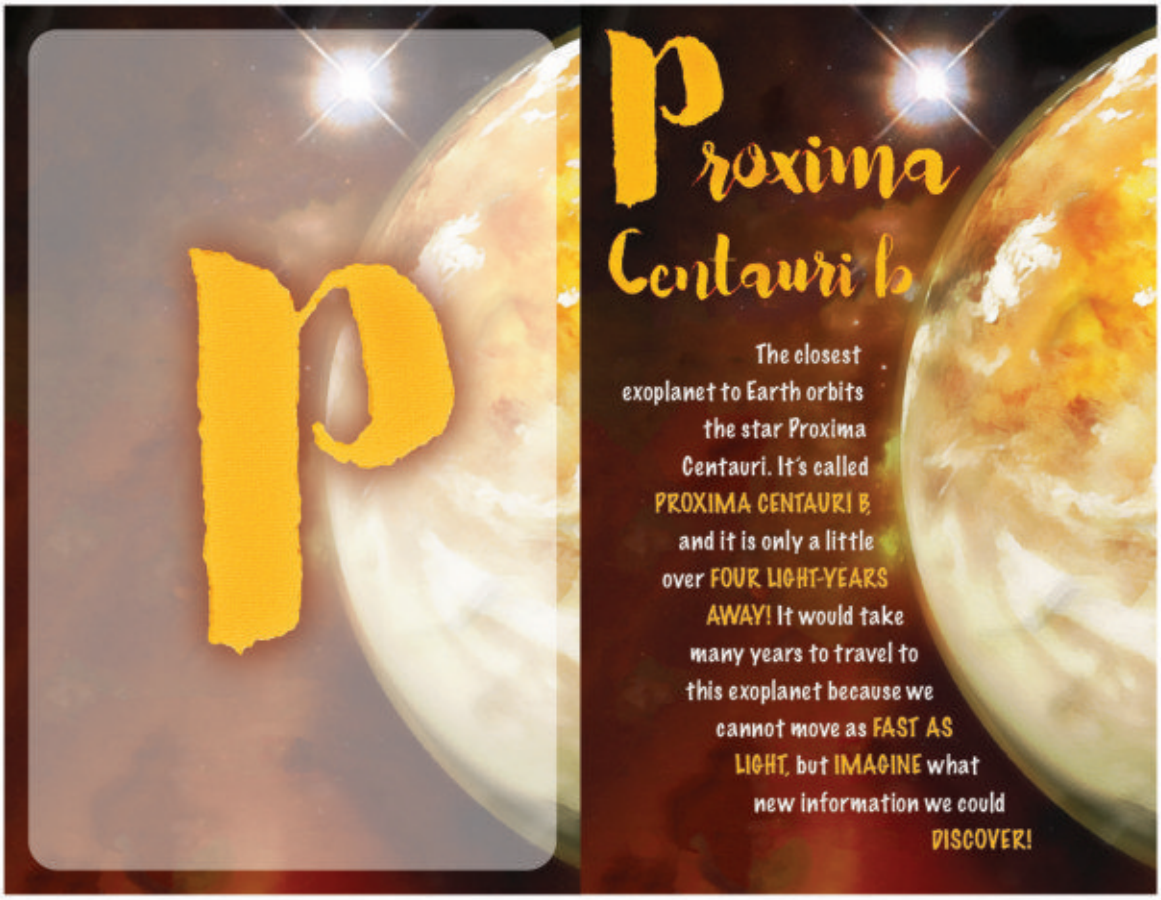

K
Kepler was the FIRST NASA mission to find EARTH-SIZE PLANETS orbiting nearby stars. The spacecraft was named after JOHANNES KEPLER, a famous mathematician and astronomer who discovered and wrote MATH EQUATIONS explaining how the planets in our solar system travel around the sun. The KEPLER MISSION has found thousands of new EXOPLANETS to study!
KEPLER - 22B
KEPLER - 69C
KEPLER - 69E
KEPLER - 62F
EARTH


L
LIGHT YEARS
Here on Earth, we have many DIFFERENTLY SIZED UNITS to measure how far away something may be or how big something is. Astronomers commonly use the LIGHT-YEAR, the distance light travels in one year.
ONE LIGHT-YEAR is equal to about 5878499810000 MILES! One of the CLOSEST known exoplanets to Earth is 4.22 LIGHT-YEARS AWAY.


M
exo moons
Many planets in our solar system have moons. Astronomers believe exoplanets might have moons, too!
They would be called exomoons and are very difficult to find because they are smaller than planets and DO NOT PRODUCE THEIR OWN LIGHT.
Astronomers are developing new techniques to help make finding them easier.

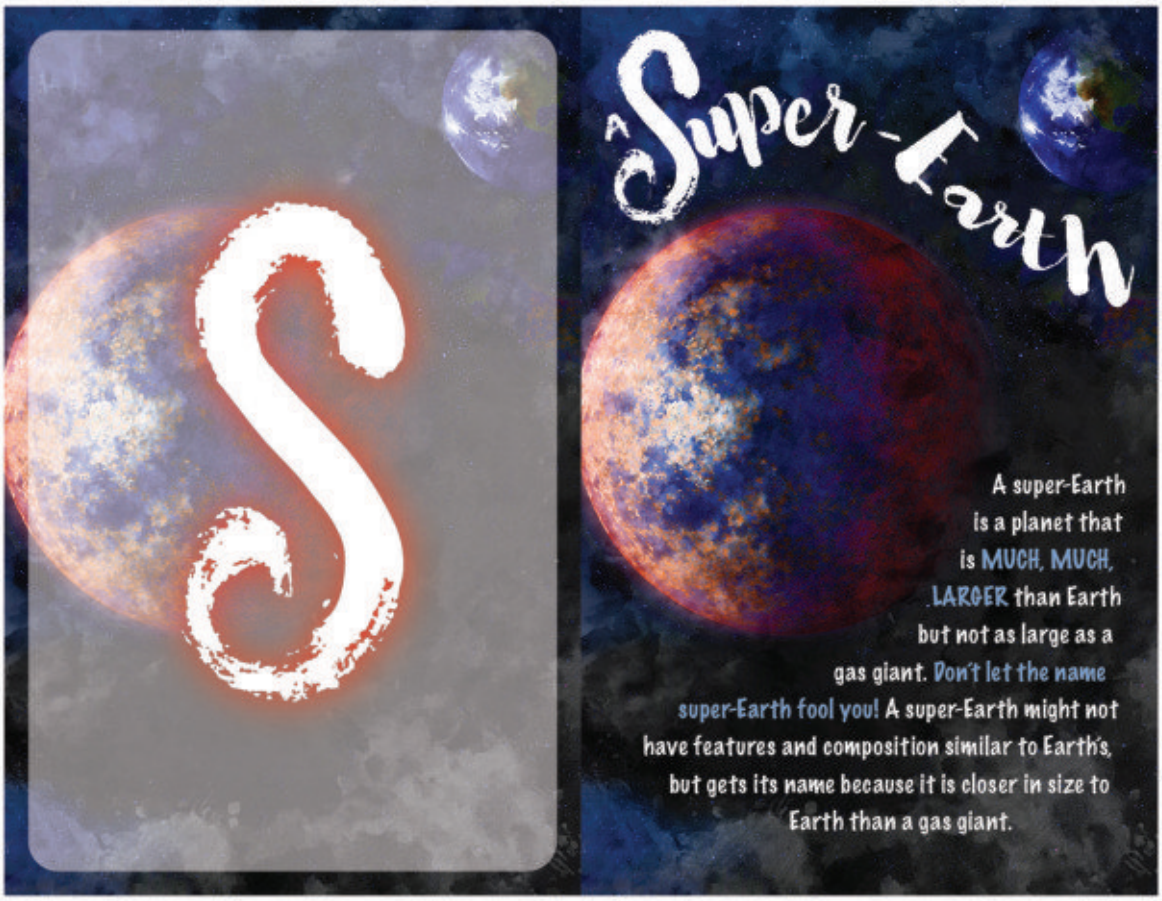

N
mini
NEPTUNE
Some EXOPLANETS resemble the GAS PLANETS in our own solar system, but they're MUCH SMALLER! These planets are called MINI-NEPTUNES. They are closer in size to Earth than Neptune, but astronomers can tell they're gas planets because they are much LESS DENSE than a rocky world.

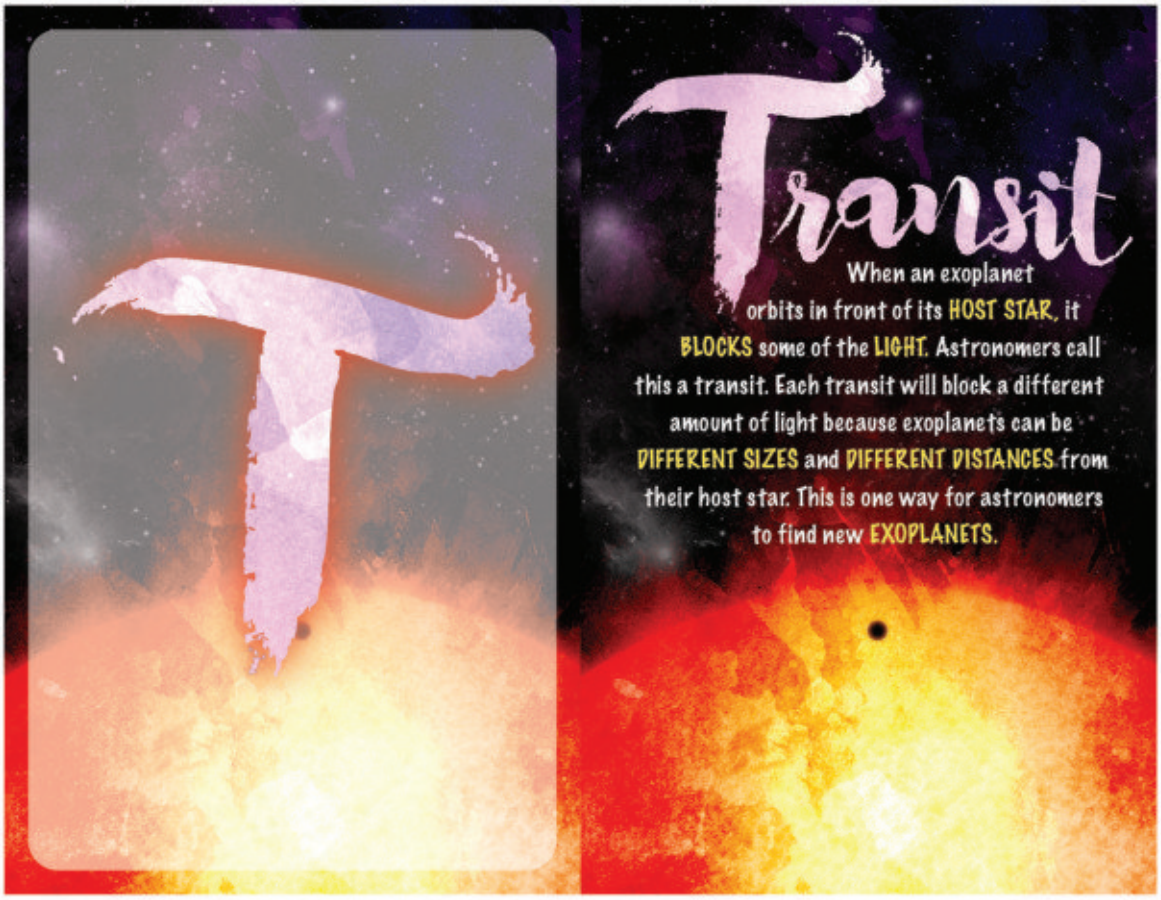

O
Observatory
Different types of scientists have DIFFERENT PLACES where they conduct their research and collect their data. Astronomers use telescopes to collect data and study celestial objects. These telescopes are housed in observatories. Ground-based observatories use visible light and radio to study space, and are located in various places on the SURFACE OF THE EARTH. Many observatories have special times when guests can visit! Check out a local observatory near you!

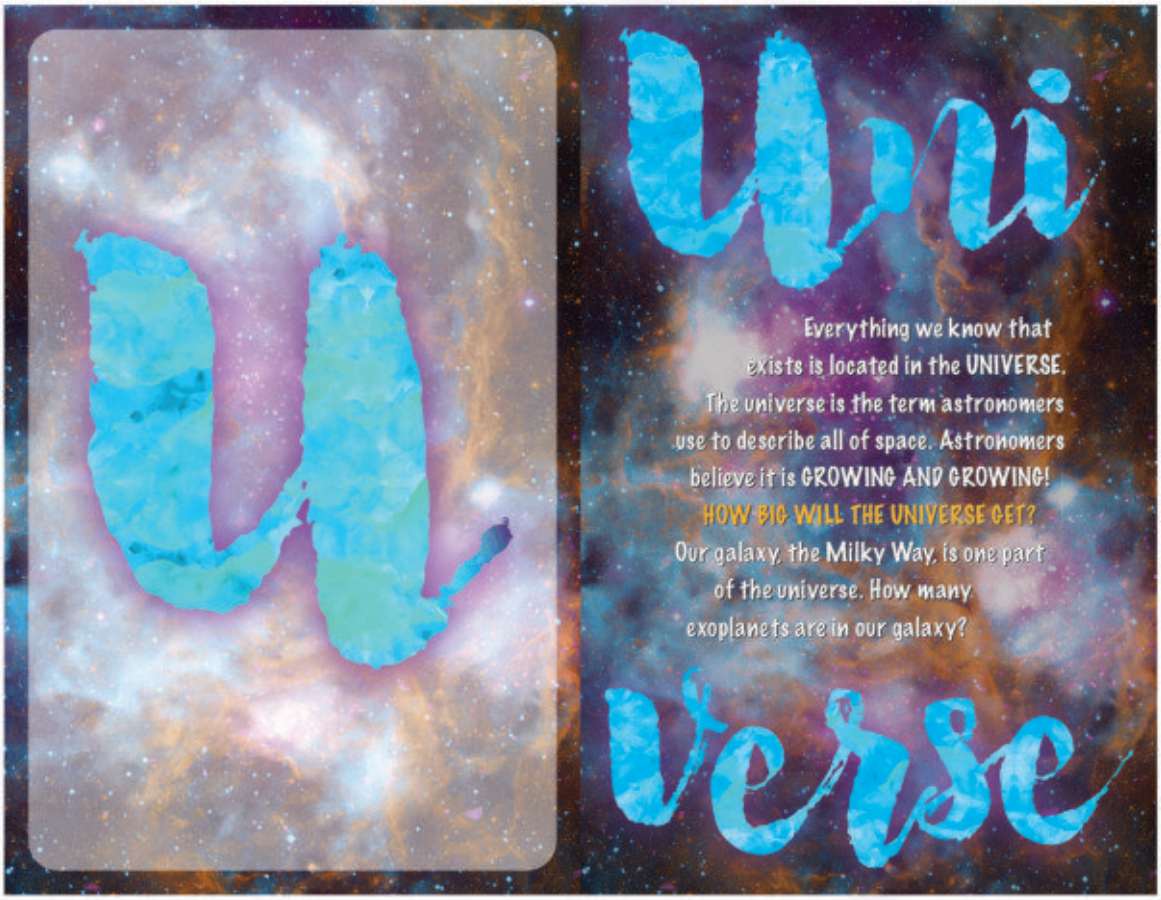

p
Proxima Centauri b
The closest exoplanet to Earth orbits the star Proxima Centauri. It's called PROXIMA CENTAURI B, and it is only a little over FOUR LIGHT-YEARS AWAY! It would take many years to travel to this exoplanet because we cannot move as FAST AS LIGHT, but IMAGINE what new information we could DISCOVER!


q
uestions
With astronomers discovering NEW WAYS to find exoplanets and new observatories being built, the quest for NEW WORLDS is just beginning! Many questions are being asked, scientists are studying data and new missions are being designed to help find ANSWERS.


R
Rocky Worlds
Rocky worlds are PLANETS that have a solid surface and are made of rocky materials. They are similar to Mercury, Venus, Earth and Mars. Rocky worlds are much SMALLER THAN GAS PLANETS, like Hot Jupiters. If we are going to find life like we have here on our Earth, a rocky world would be a GOOD PLACE TO LOOK!


S
A Super-Earth
A super-Earth is a planet that is MUCH, MUCH, LARGER than Earth but not as large as a gas giant. Don't let the name super-Earth fool you! A super-Earth might not have features and composition similar to Earth's, but gets its name because it is closer in size to Earth than a gas giant.


T
Transit
When an exoplanet orbits in front of its HOST STAR, it BLOCKS some of the LIGHT. Astronomers call this a transit. Each transit will block a different amount of light because exoplanets can be DIFFERENT SIZES and DIFFERENT DISTANCES from their host star. This is one way for astronomers to find new EXOPLANETS.


U
Uni
Everything we know that exists is located in the UNIVERSE. The universe is the term astronomers use to describe all of space. Astronomers believe it is GROWING AND GROWING! HOW BIG WILL THE UNIVERSE GET? Our galaxy, the Milky Way, is one part of the universe. How many exoplanets are in our galaxy?
verse


V
radial
Velocity
One of the ways astronomers DISCOVER exoplanets is called RADIAL VELOCITY. STARS aren't completely still in space when an exoplanet is orbiting them. The planet TUGS on the star ever so SLIGHTLY, causing it to move in a small circle. These movements affect a star's LIGHT SPECTRUM. When the planet is moving TOWARD US, the COLORS will appear SHIFTED toward the color BLUE. When moving AWAY from us, the color spectrum is SHIFTED toward RED. These shifts can be measured and show a planet is in ORBIT.


W
WATER WORLD
A WATER WORLD, or an ocean planet, is a planet that astronomers think could be entirely COVERED BY WATER. With all of that water, it may be hard to have LAND-BASED life forms. However, if the planet could have life, imagine all of the new types of WATER LIFE that could be discovered!


X
X-rays
Astronomers call the light we see with our eyes "VISIBLE LIGHT," but visible light only makes up a small portion of all the light in the UNIVERSE! X-rays are a special type of light astronomers use to observe exoplanets transiting their host star. X-RAYS provide DIFFERENT INFORMATION than visible light.


y
YEAR
The time it takes for a planet to ORBIT around its star is called a year, or an ORBITAL PERIOD. Different planets have DIFFERENT year LENGTHS. The length of the planet's year depends on how close it is to its HOST STAR. The closer the planet is to its host star, the SHORTER its YEAR will be.


Habitable
Zone
Every star has three SPECIAL ZONES surrounding it. These zones are divided by TEMPERATURE. Just like in Goldilocks, there is a zone that's TOO HOT for life, a zone that's TOO COLD and one that is JUST RIGHT! The middle zone is the "just right" zone, called the HABITABLE ZONE. Planets there are the most likely to support life!


Tess
Tess
NASA's Transiting Exoplanet Survey Satellite (TESS) will DISCOVER thousands of EXOPLANETS in orbit around the brightest stars in the sky. TESS is the first space mission to search nearly the entire sky for exoplanets. In a TWO-YEAR ALL-SKY SURVEY, it will monitor more than 200,000 STARS for short drops in brightness caused by exoplanets passing in front of them, called TRANSITS.
WHAT NEW WORLDS WILL IT FIND?
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