Little Leonardo's™ MakerLab: Space includes a collection of simple hands-on activities for young readers interested in astronauts, outer space, rockets, space exploration, and astronomy. Activities included range from building a simple model illustrating the vast scope of our solar system to a demonstration of the speed of light. Also includes a glossary of key terms.

With original Renaissance man **Leonardo da Vinci** as inspiration, the Little Leonardo's™ MakerLab series of books include fun hands-on activities designed to engage children's hands and minds, which helps them better understand and retain the knowledge gained from the activities.

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LITTLE LEONARDO'S™ MakerLab SPACE

King ★ Paprocki

GIBBS SMITH

LITTLE LEONARDO'S™

MakerLab SPACE

MORE THAN 20 HANDS-ON ACTIVITIES!

Written by
BART KING

Illustrated by
GREG PAPROCKI

Leonardo da Vinci (1452-1519) was born in Italy, the son of a gentleman of Florence. He made significant contributions to many different disciplines, including anatomy, botany, geology, astronomy, architecture, paleontology, and cartography.

He is one of the greatest and most influential painters of all time, creating masterpieces such as the *Mona Lisa* and *The Last Supper*. And his imagination led him to create designs for things such as an armored car, scuba gear, a parachute, a revolving bridge, and flying machines. Many of these ideas were so far ahead of their time that they weren't built until centuries later.

He is the original "Renaissance Man" whose genius extended to all five areas of today's STEAM curriculum: Science, Technology, Engineering, the Arts, and Mathematics.

You can find more information on Leonardo da Vinci in *Who Was Leonardo da Vinci?* by Roberta Edwards (Grosset & Dunlap, 2005), *Magic Tree House Fact Tracker: Leonardo da Vinci* by Mary Pope Osborne and Natalie Pope Bryce (Random House, 2009), and *Leonardo da Vinci for Kids: His Life and Ideas* by Janis Herbert (Chicago Review Press, 1998).

LITTLE LEONARDO'S™

MakerLab SPACE

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GIBBS SMITH
TO ENRICH AND INSPIRE HUMANKIND

SEEING THE SUN

To warm up your imagination, picture the Earth. Think of all the animals and people who live here. Think of how long it would take you to walk to another city. So Earth seems pretty big, right?

But a *million* Earths could fit inside our Sun.

Now *that's* big.

The Sun is also a **star,** like the ones you see in the sky. And it's not even very big compared to most of those stars. The Sun is in a category called **yellow dwarf stars.**

But big or small, the Sun is the center of our solar system. Its warmth and light keep everything on Earth alive.

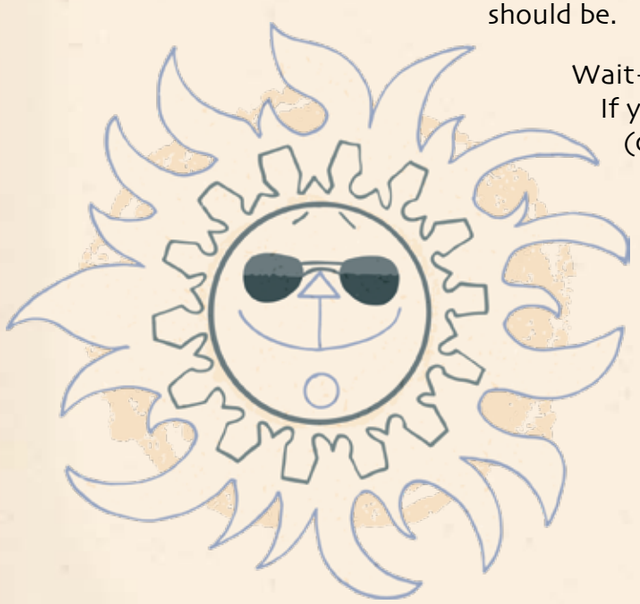
CAUTION: You should *never* look directly at the Sun. (It can cook your eyeballs!)

What You Need:

- Crayons or markers

What You Do:

See the picture below? Imagine that's the Sun. But is it the right color? If not, just color it in the way it should be.



Wait—are you reaching for a *yellow* crayon? If you look at the Sun from outer space (or anywhere but Earth) it's *white.* The reason the Sun looks yellow to us is because of Earth's air. (This air is called our **atmosphere.**)

But you know what? Go ahead and color it yellow. Or orange. Or red!

What You Need to Know:

Because of the presence or lack of an atmosphere and the distances involved, the Sun looks different from other planets:

Mercury: Since this planet is very close to the Sun, it's twice as big in the sky on Mercury as it is on Earth.

Venus: You can barely see the Sun through this planet's thick clouds. And the sky on Venus is orange.

Mars: The Sun is farther away from Mars than Earth, so it looks smaller. The sky on Mars is butterscotch colored, and sometimes pink.

Jupiter: The clouds here are too thick to even *see* the Sun.

Saturn: The Sun is much smaller and dimmer than what we see on Earth.

Uranus and Neptune: From these two planets, the Sun looks like a very, very bright star. It's still brighter than a full Moon seen from Earth, though.

LIFT YOUR OWN WEIGHT

You are always being pulled on. The thing pulling you is called **gravity.** Gravity is a force that pulls two objects toward each other. So gravity pulls the Earth toward the Sun, and it pulls you toward the Earth. The more massive something is, the more gravity it has.

What You Need:

- A bowling ball (or any object that weighs about 15 pounds)

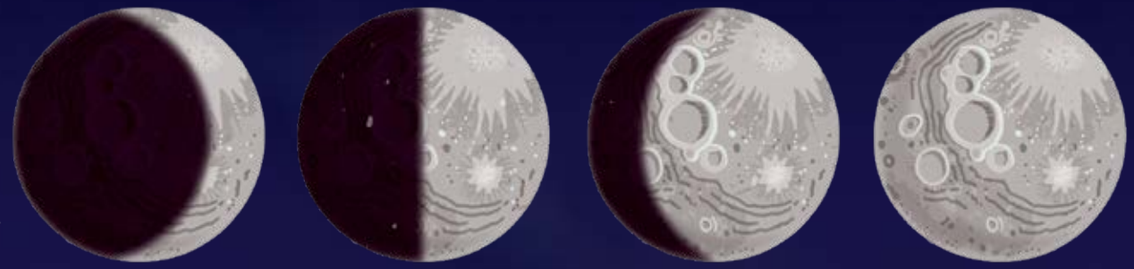
What You Do:

1. The Moon is smaller than the Earth. So if you went to the Moon, you would weigh less than you do here. But how much less?
2. Go to a bowling alley or other place with bowling balls. Pick up a ball. (Be careful you don't drop it on your toe.)
3. That ball is pretty heavy, right? Well guess what? You just picked up yourself! On the Moon, you would weigh about as much as that bowling ball.
4. Now roll your ball down the lane. (If you get a strike, you can have a free snow cone.)

What You Need to Know:

We know the Moon orbits the Earth. That means that sometimes the Earth comes *between* the Sun and the Moon. When that happens, the Earth's shadow falls on the Moon. That shadow gives the Moon a different shape on different days.

In other words, the Earth's shadow changes what the Moon looks like to us. For example, sometimes the Moon is shaped like a banana. That's called a **crescent moon.**



crescent quarter gibbous full

Once a month, there is a **full moon.** That's when *none* of the Earth's shadow hits the Moon and we can see one whole side of it. A full moon is so bright it casts shadows on Earth. It helps us see at night.

SUPERPOWER: NIGHT VISION

When you're in bright places it's easy to see. But when it's dark, your eyes can adjust.

What You Need:

- Your eyes
- An outdoor spot without cars, houses, or streetlights nearby
- A flashlight with its end covered in red cellophane

What You Do:

1. Go to your outdoor spot.
2. If you brought a light besides the red flashlight, turn it off. Wait for your eyes to adjust.
3. Look up. Have you ever wondered how many stars are in the sky? If the Moon isn't out, we can see about 3,000.

What You Need to Know:

Try not to look at regular light or you'll lose your night vision. As long as you don't look at regular light, within 30 minutes your eyes will be more than *twice* as good at seeing in the dark. It's okay to look at your flashflight though. That red covering on its end will not hurt your night vision. That's why astronomers cover their flashlights the same way.

THE SPEED OF LIGHT

Did you know that light has a speed? It moves at 186,000 miles a second. That's very fast, but in space, distances are huge. When sunlight leaves the Sun, it takes 8 minutes and 20 seconds to get to us.

What You Need:

- ⌑ Binoculars
- ⌑ Flashlight (red cellophane optional)
- ⌑ A clear night when the Moon is out
- ⌑ An outdoor spot without cars, houses, or streetlights nearby

What You Do:

1. After you get to your outdoor spot, wait for your eyes to adjust to the dark.
2. Look up at the Moon. It should be bright, because the Moon is lit by the Sun. Remember, the light hitting the Moon left the Sun about 8½ minutes ago.
3. Turn on your flashlight and aim it at the Moon. Try to watch the light leave your flashlight. Can you see it start? It's hard to catch because it's so fast.
4. Your light will reach the Moon in less than 2 seconds. Turn your flashlight off after its light gets there.
5. Now look for a star. Any star. See its light? It took a long time to get to you. It takes over 4 years for light from the nearest star to get to us. And the light from other stars is much, much older.

TRY THIS: Turn on the lights in your room. The light has to leave the light bulb and then fill up the room. But this happens so fast we can't see it happen.

MOONSHOT

What You Need:

- ⌑ Binoculars
- ⌑ Flashlight
- ⌑ A quarter
- ⌑ A small orange (or another round fruit of that size)
- ⌑ A clear night when the Moon is out (half moon or bigger)
- ⌑ An outdoor spot without cars, houses, or streetlights nearby

What You Do:

1. When you get to your outdoor spot, wait for your eyes to adjust to the dark.
2. Look at the Moon. Compared to the Sun, the Moon is small. But from Earth, both the Sun and a full Moon look like they are the same size.
3. Hold up your quarter. Can you cover the Moon with it?
4. The Moon is slowly moving away from Earth. When the Moon was formed 4 billion years ago it was much closer than it is now.
5. Now hold up your orange—4 billion years ago, the Moon would have looked *that* big in the sky!
6. Look at the Moon through your binoculars. You can see a *lot* more detail. That same side of the Moon you see has *always* faced the Earth. That means what you're seeing is the same side of the Moon that the dinosaurs saw millions of years ago.

TRY THIS: Find a map of the Moon to bring with you the next time you go outdoors to look at the Moon. With binoculars it's easy to spot major features on the moon, like big craters. And you also should be able to easily find the Sea of Tranquility, where the first astronauts landed on the Moon.

BOUNCY SOLAR SYSTEM

What You Need:

- Lots of rubber bands in different colors (brown, gray, yellow, blue, green, white, red, and orange)
- Scissors
- Scratch paper
- White card stock (thin white cardboard)
- Colored markers

What You Do:

1. You're going to make planets. The center of your planets will be crumpled-up pieces of paper.
2. Tear ½ of a sheet of paper and crumple it up into a ball. Wrap gray or brown rubber bands around it. Wrap them in different directions. When you're done, this will be Mercury.
3. Crumple up 1 full sheet of paper. Around this one wrap yellow rubber bands. When you're done, that's Venus.
4. Next up is Earth. Start with 1 piece of paper and use mostly blue rubber bands. Every so often include some white and green ones too.

5. For your next planet use ⅔ of a piece of paper. Use almost all red rubber bands for Mars, with a few brown ones every so often.
6. You're using *7* sheets of paper for the next planet. Jupiter will be covered with white and orange rubber bands.
7. For Saturn, you need 5½ sheets of paper. Cover it with mostly yellow and some white rubber bands.
8. For Saturn's rings you'll use the white card stock. First, cut out a circle that will fit right around your Saturn. Once you're done, use colored markers to add colors to both sides. Saturn's rings are pink, gray, and brown, but you can have fun and color them any way you want.
9. You need 3½ sheets of paper for Uranus. Use mostly blue rubber bands (light blue, if you have them), and a few whites and grays.
10. Use just 3 sheets of paper for the last planet, Neptune. It gets blue rubber bands.
11. Optional: You can add the dwarf planet Pluto if you want, which orbits the sun beyond Neptune. For Pluto, start with ¼ of a sheet of paper and wrap it with white rubber bands.
12. Line up your planets on the floor and turn on a flashlight at one end. That's the sun!
13. Optional: You can hang your rubber band planets as a mobile. Wrap fishing line around them and hang them up.

FUN FACT: Pluto was named by an 11-year-old girl named Venetia Burney.

COMET CHASING

A **comet** is a big chunk of ice and dirt that orbits the Sun. Sometimes those orbits go way, way out beyond the furthest planet. As the comet flies, it leaves a "tail" behind it made of bits of itself. These tails can stretch for millions of miles.

What You Need:

- Enough people to play tag
- An outdoor area

What You Do:

1. Pick one player to be the Comet.
2. The Comet tries to tag the other players.
3. If another player gets tagged, they have to follow the Comet. The tagged players are part of the Comet's tail, so they chase the Comet.
4. The last player not to get tagged wins . . . and gets to be the new Comet!

ROCKET TO SPACE

What You Need:

- ⌑ Balloons (different shapes are fine, but try starting with a long one)
- ⌑ String or yarn
- ⌑ A straw
- ⌑ Good tape
- ⌑ Scissors
- ⌑ Paper
- ⌑ Two chairs (or any other two level objects)
- ⌑ One other person

What You Need to Know:

A **galaxy** is a group of stars and planets held together by gravity. Our galaxy is called the **Milky Way.**

What You Do:

1. Find a space in your house where you can stretch a string for a long, straight distance. It might be a hallway or across the length of your living room. Set the two chairs at each end of this length.
2. Tie one end of the string to one chair. That's the Andromeda galaxy.
3. Unroll the string all the way to the second chair. That's Earth.
4. Tape the straw to the side of a balloon (don't blow it up yet!). Then thread the string through the straw. Make sure the open end of the balloon is facing the second chair.
5. Blow up the balloon taped to the straw. Don't tie off the end of the balloon; instead, just hold it shut.
6. While you're holding the end of the balloon, have the other person tie the second end of the string to the second chair.
7. Let go of the end of the balloon. You've just launched your rocket from Earth. How far did it go? Did it reach Andromeda?
8. Try another rocket launch. This time blow up the balloon *before* taping it to the straw and threading the string through it. (You'll have to untie the string from the second chair first.)
9. Which rocket launch method worked better?
10. Cut out paper fins for your rocket. Tape them onto your balloon (*after* you blow it up). Do the fins help the rocket go farther?
11. Try more launches with different sizes of balloons. Does the size of the balloon make a difference on how far your rocket travels?

GLOSSARY

ARTIFICIAL SATELLITE: Any object made by humans that orbits a planet.

ASTEROID: A rock that orbits the sun.

ASTRONAUT: A person who travels into space. The first astronauts were in the 1960s.

ASTRONOMY: The study of faraway things like stars, planets, and galaxies.

ASTRONOMICAL UNIT (AU): The distance between the Earth and the Sun.

ATMOSPHERE: Air that surrounds some planets and moons.

COMET: Small, icy objects in our solar system.

CONSTELLATION: A group of stars that seems to make the outline of an object.

CRESCENT MOON: The curved sliver of the Moon that we see in the sky. It will look fatter every night until it is a **FULL MOON**.

DWARF PLANET: Any really big asteroid or moon not quite big enough to be a planet, like Pluto.

FULL MOON: The full, round, sunlit face of the Moon that we see in the sky.

GALAXY: A large group of stars and planets held together by gravity.

GRAVITY: A force that pulls items toward each other.

MILKY WAY: The name of the galaxy our solar system is a part of.

OUTER SPACE: Everything outside of Earth's atmosphere. The Moon, the solar system, and the rest of the universe are part of outer space.

ORBIT: To revolve around something.

PLANET: A large object orbiting a star. Earth is a planet orbiting the Sun.

PLANETARIUM: A large building where stars and planets are projected on the inner surface of a giant dome.

SATELLITE: Any object that orbits a planet. Also called a **MOON**.

SCALE MODEL: A small, exact copy of a larger object.

SOLAR SYSTEM: Our Sun, and all the planets, moons, asteroids, and comets that orbit it.

STAR: A hot, massive ball of gas that's often the center of a solar system.

TELESCOPE: A tool to help us see far away.

YELLOW DWARF STARS: A class of fairly small stars that last about 10 billion years. The Sun is in this class.

ZERO GRAVITY: A condition that happens in places like outer space where the force of gravity doesn't exist. In zero gravity you feel weightless.

ALSO AVAILABLE

LITTLE LEONARDO'S MAKERLAB: ROBOTS

Bart King • Illustrations by Greg Paprocki

If you have young readers who are interested in robots, robotics, coding, and artificial intelligence, here are some simple hands-on activities to get them inspired. They range from building very simple robots from common household items to creating code to make robots perform basic tasks. The activities are designed to engage both the readers' hands and minds, which helps them better understand and retain the knowledge gained from the activities.

GREG PAPROCKI works full-time as an illustrator and book designer. He has illustrated several Curious George books, as well as previous books in the Little Leonardo series, the BabyLit alphabet book series, and *The Big Book of Superheroes* for Gibbs Smith. His Gibbs Smith titles have sold over 130k copies. He lives in Lincoln, Nebraska.

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