

GET TO KNOW YOUR UNIVERSE!

SCIENCE COMICS

SOLAR SYSTEM

Our Place in Space



**ROSEMARY
MOSCO**

**JON
CHAD**



SOLAR SYSTEM

Our Place in Space



SOLAR SYSTEM

Our Place in Space

ROSEMARY MOSCO

and

JON CHAD

with color by
Luke Healy



First Second
New York

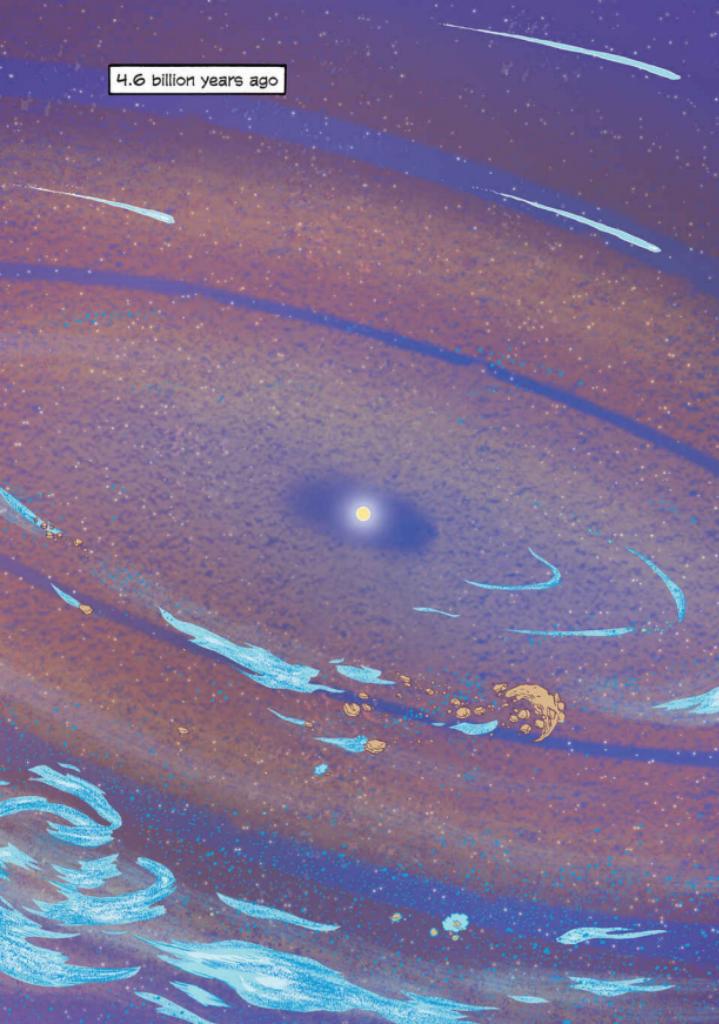


PART 1: INTRODUCTION

Our Solar System,
5 billion years ago



4.6 billion years ago

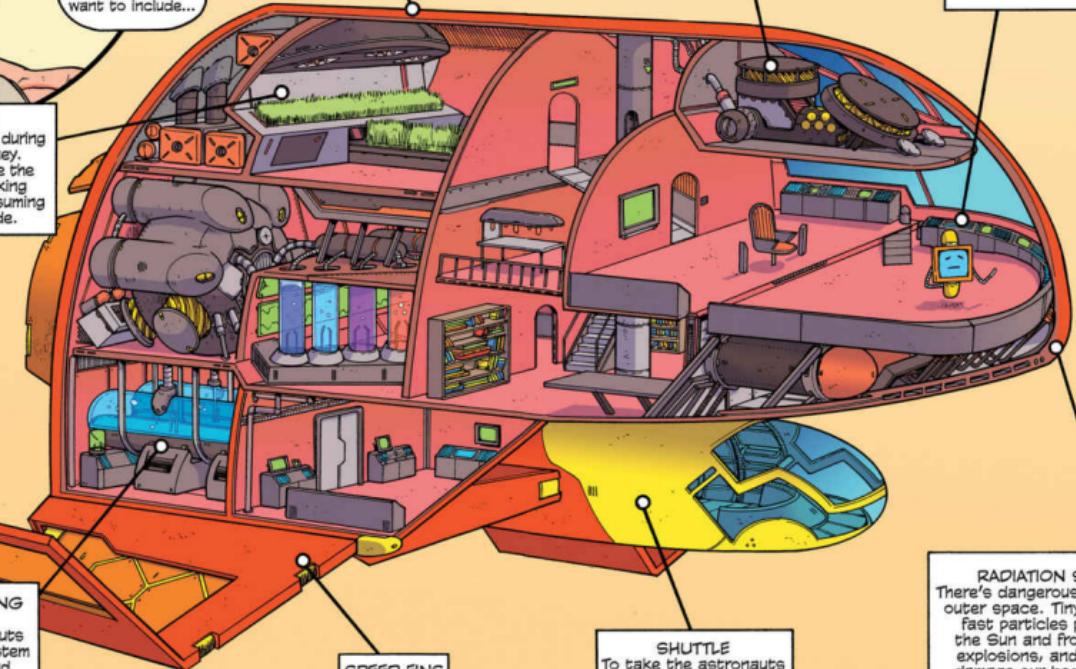


Present day









GARDEN
To feed our crew during the long journey. The plants make the air safe by making oxygen and consuming carbon dioxide.

HEAT-RESISTANT COVERING
We'll need to block a lot of heat. Blasting off from Earth can raise our ship's temperature to over 350°F, and the Sun's surface hits over 9,900°F!

GRAVITY MACHINE
On Earth, a force called gravity pulls us toward the center of the planet. It keeps our feet on the ground and stops our stuff from floating away. Let's include an imaginary gravity machine.

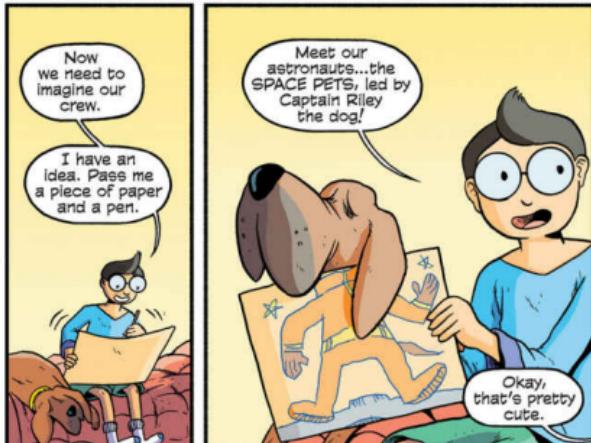
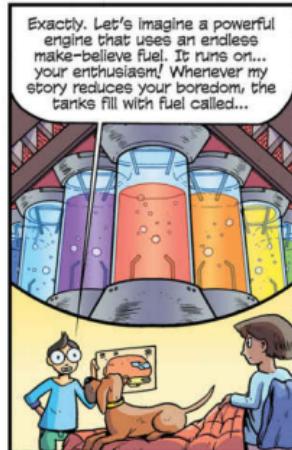
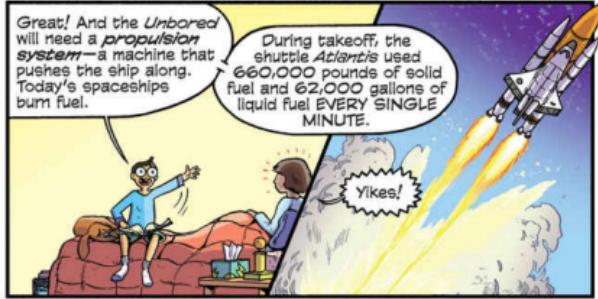
SMART NAVIGATION COMPUTER
Your GPS won't work in outer space—it relies on information from satellites that orbit Earth. Compasses won't work either because they respond to the Earth's magnetic field. We'll need a clever computer to guide us.

WATER RECYCLING SYSTEM
Today's astronauts already use a system that cleans and recycles liquids—even (eww) pee!

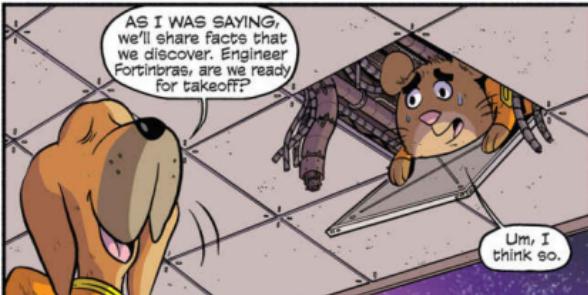
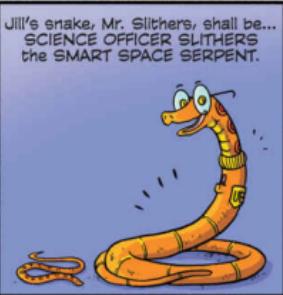
SPEED FINS
They just look cool.

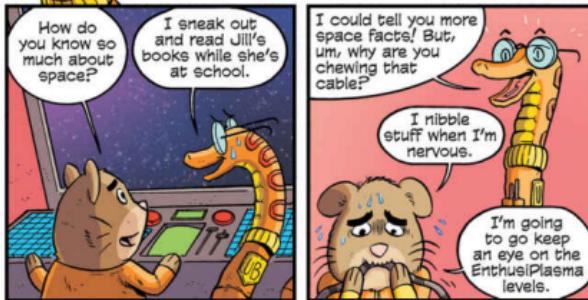
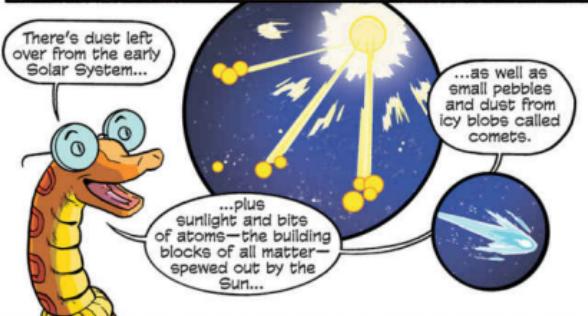
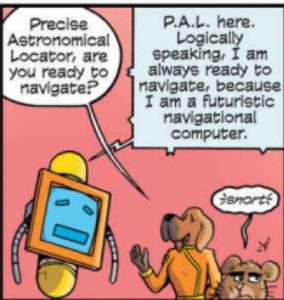
SHUTTLE
To take the astronauts to the surface of the planets.

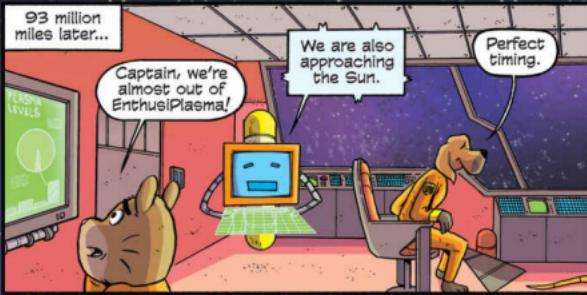
RADIATION SHIELD
There's dangerous radiation in outer space. Tiny, incredibly fast particles pour from the Sun and from distant explosions, and they can damage our bodies. Let's shield our astronauts!



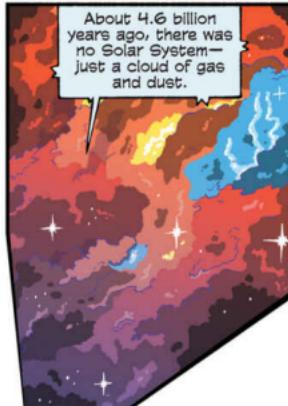
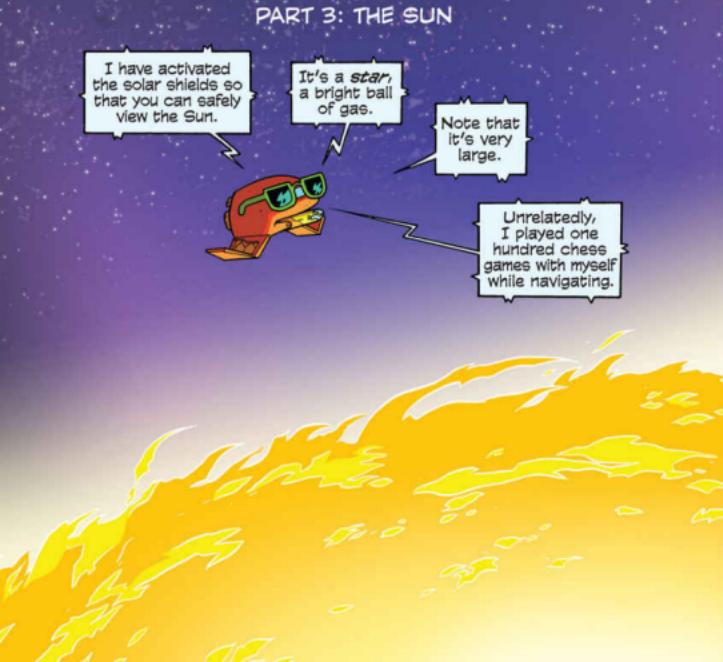
PART 2: TAKEOFF

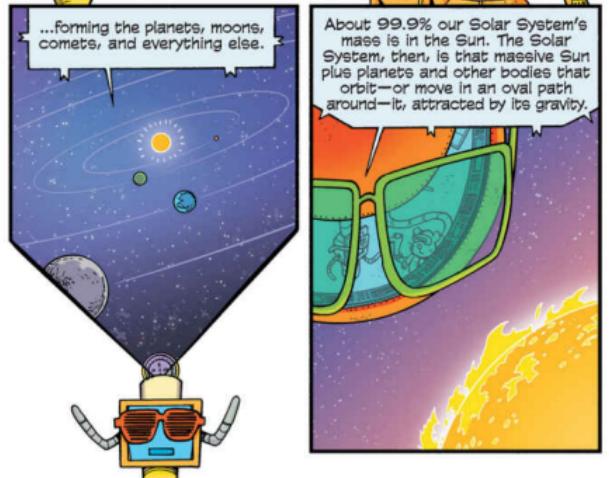
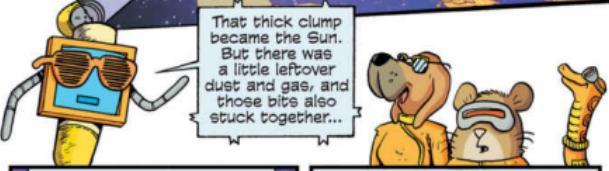
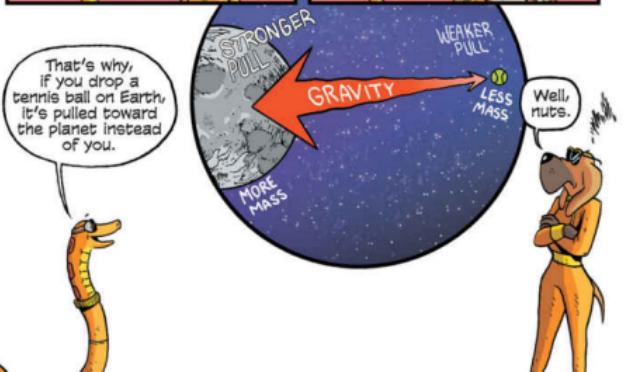
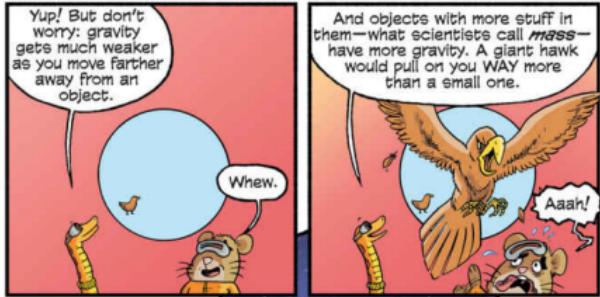
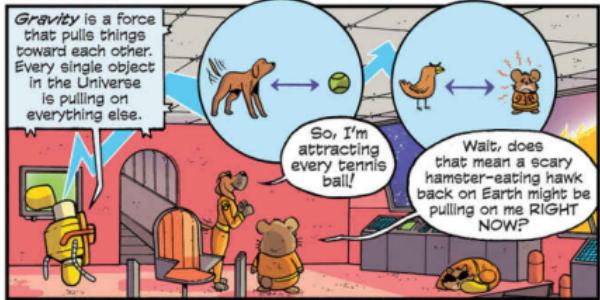


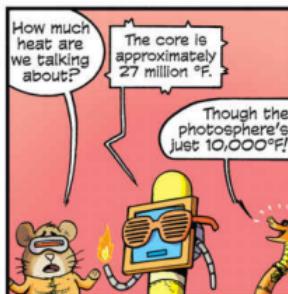
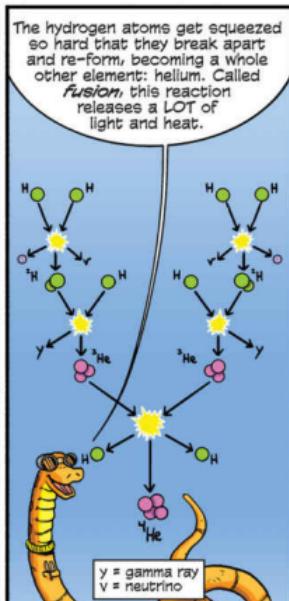
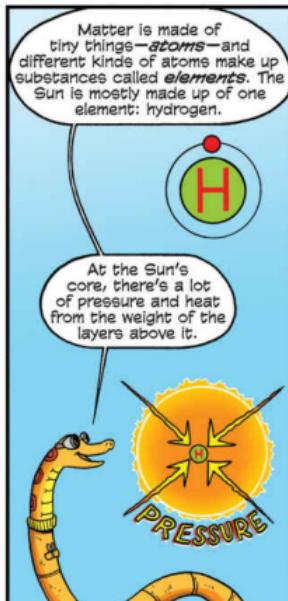
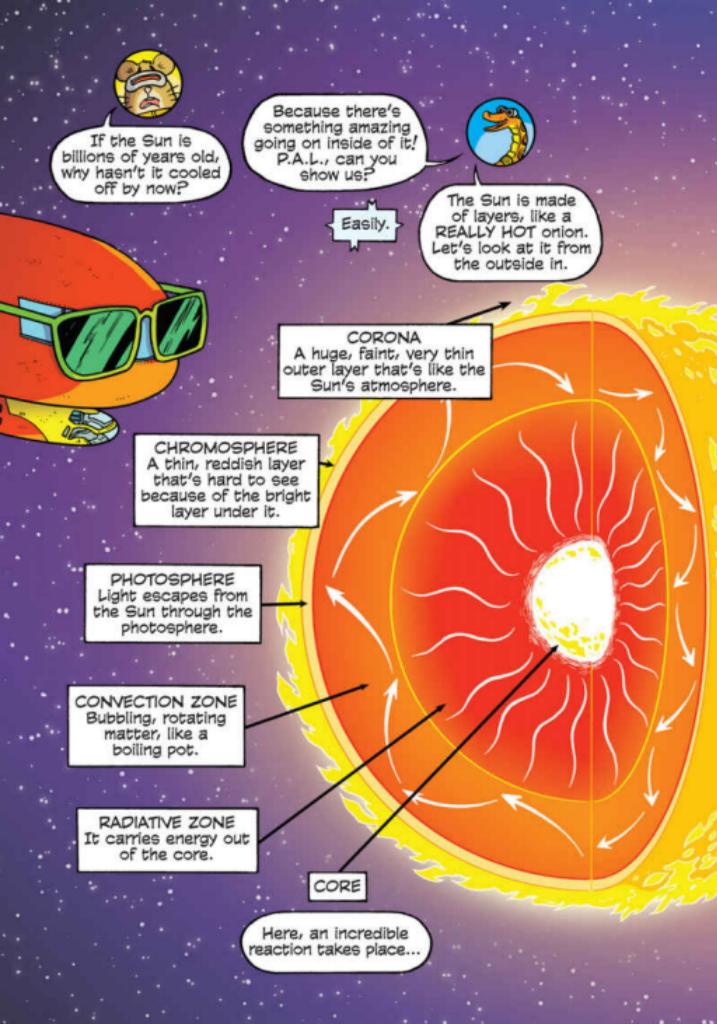




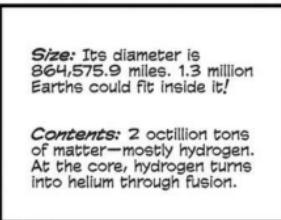
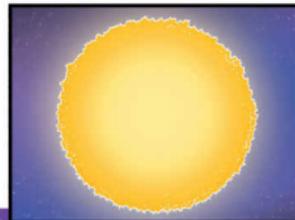
PART 3: THE SUN







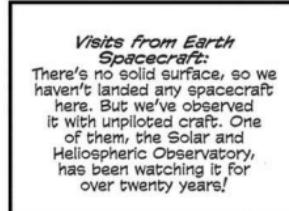
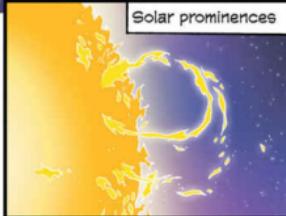
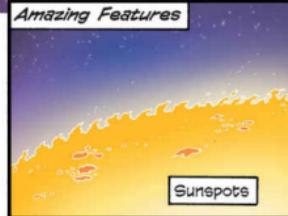
THE SUN: A REPORT



THE SUN'S PLACE IN SPACE

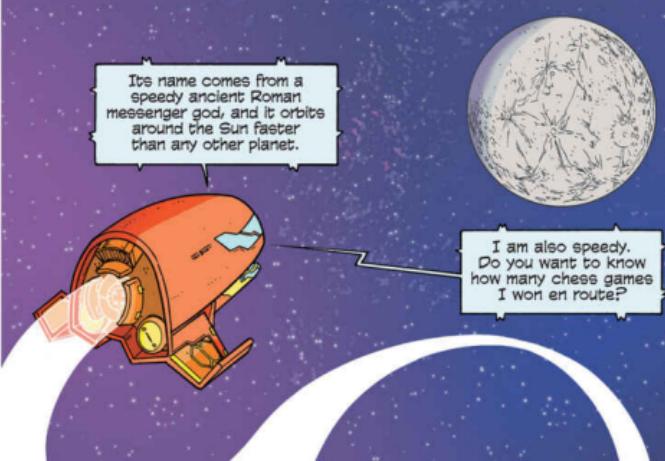


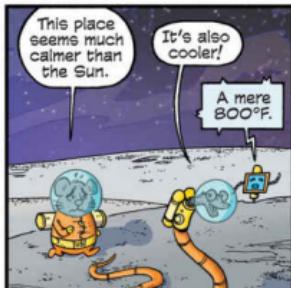
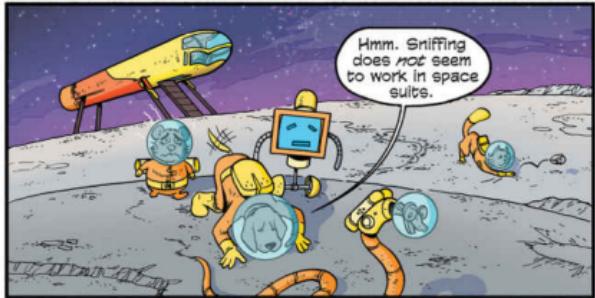
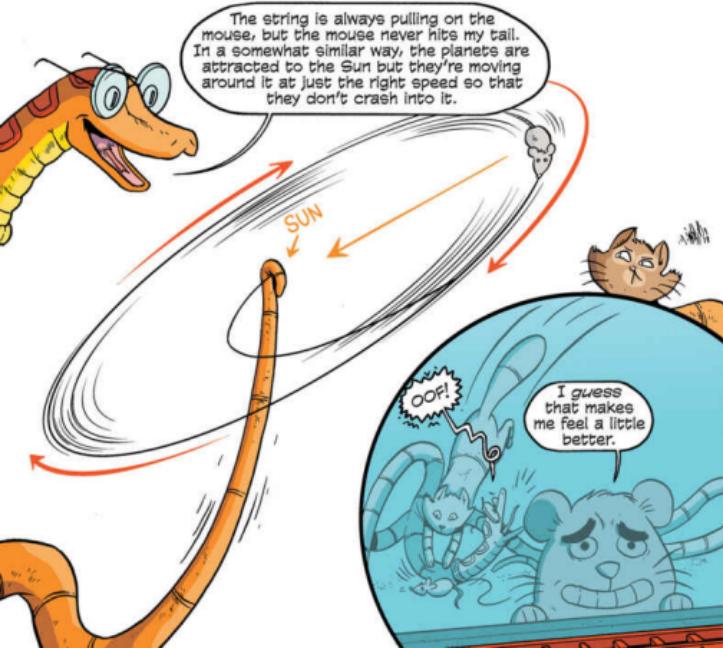
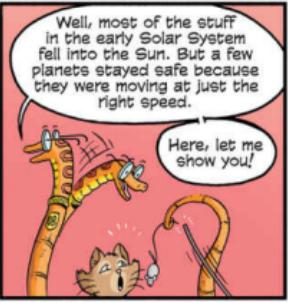
Amazing Features

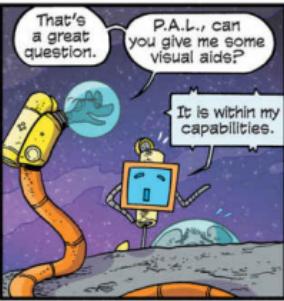




PART 4: MERCURY







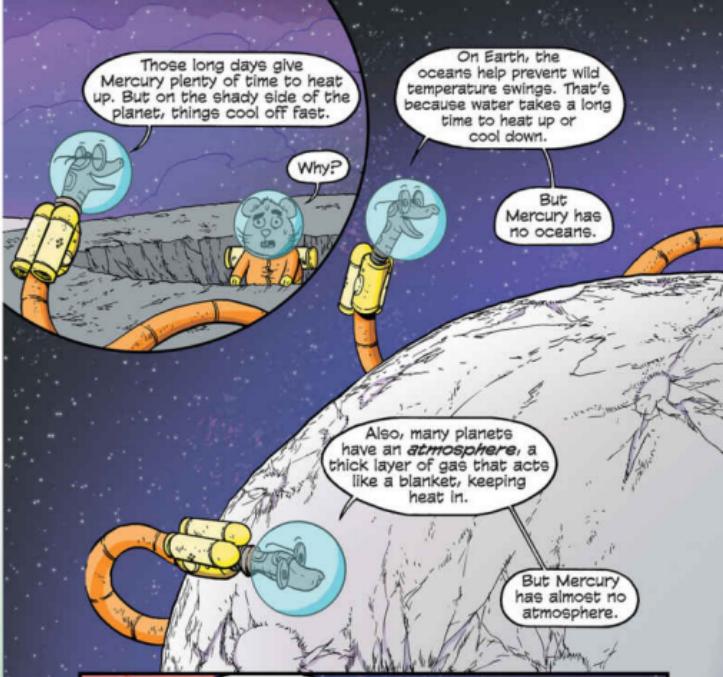
SUN

First off, a day on Mercury lasts a long time. While the Earth takes about twenty-four hours to rotate around on its axis, Mercury takes almost two Earth months.

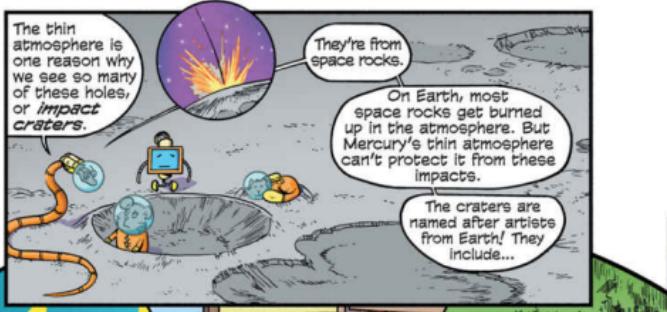
That slow spin plus the speed at which Mercury travels around the Sun, make for long days. Stand in one place and you may have to wait six Earth months from sunrise to sunrise!

Planet	Day Length
Mercury	1,408 hours
Venus	5,832 hours
Earth	24 hours
Mars	25 hours
Jupiter	10 hours
Saturn	11 hours
Uranus	17 hours
Neptune	16 hours

What? Why's that?



MERCURY: A REPORT



Origin of Name: The ancient Roman messenger god.

Size: 3,031.7 miles in diameter, just 1/3 the width of Earth.

Contents: Like the other planets, it has layers. During Mercury's formation, gravity pulled the heaviest stuff (mostly metal) to the core, which is now liquid iron. The lighter stuff (mostly rock) floated to the surface.

MERCURY'S PLACE IN SPACE



Amazing Features

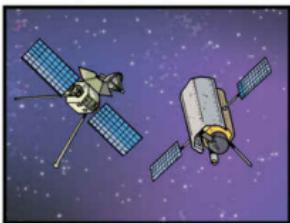


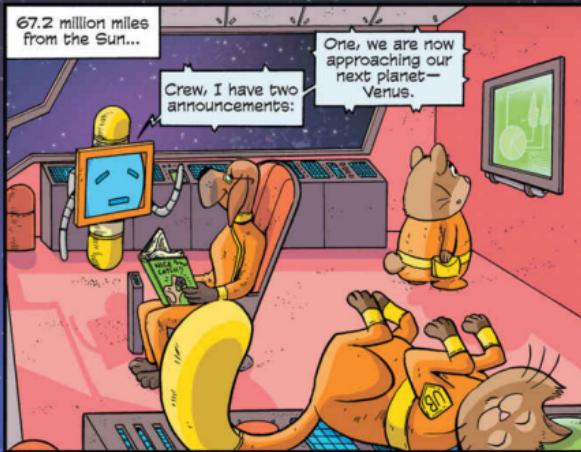
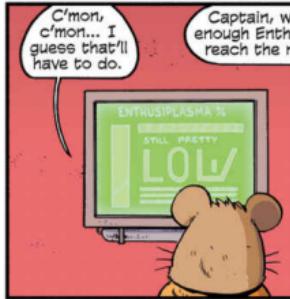
Visits from Earth Spacecraft:

Mercury is hard to visit because of the extreme temperatures and the strength of the Sun's gravity at that distance.

Mariner 10 flew by 1974-75.

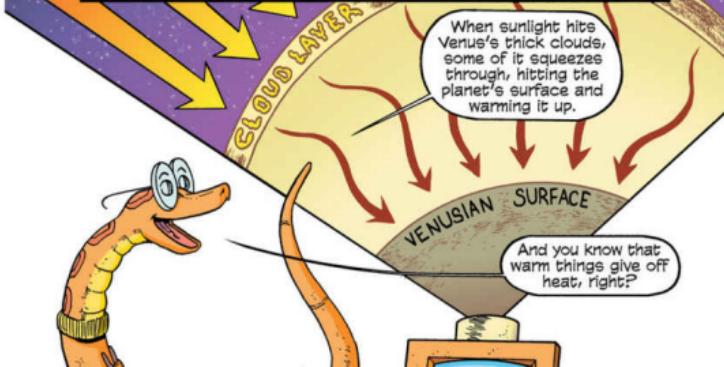
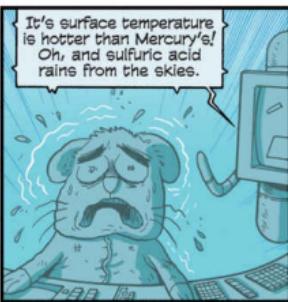
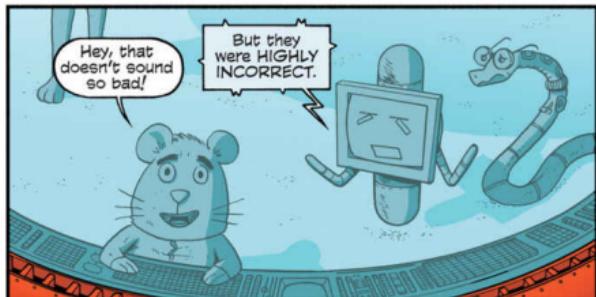
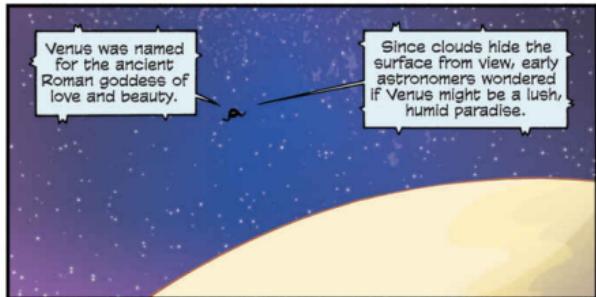
MESSENGER orbited 2008-2015. Europe's *BepiColombo* arrives in 2025!!

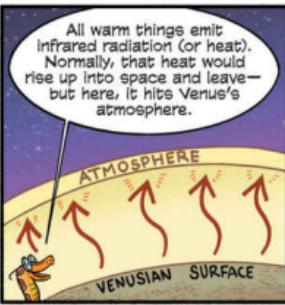




PART 5: VENUS

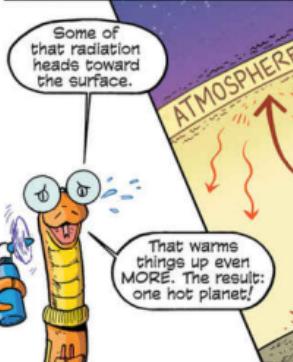






Most of that atmosphere—96.5 percent—is made of a gas called carbon dioxide, or CO_2 .

CO_2 absorbs the radiation, vibrates and heats up, and sends it back out in different directions.



That warms things up even MORE. The result: one hot planet!



VENUS: A REPORT



Origin of Name: The ancient Roman goddess of love and beauty.

Size: 7,520.8 miles across—just a little smaller than the Earth.

Contents: An iron core, a rocky mantle, and a rocky crust, plus a thick atmosphere.

VENUS'S PLACE IN SPACE

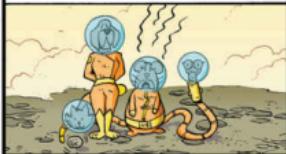


Amazing Features

Thick, bright clouds.

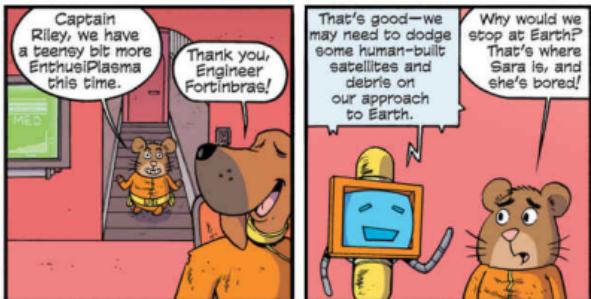


A rocky surface that only a few unpiloted spacecraft—and now a few brave Space Pets—have touched.

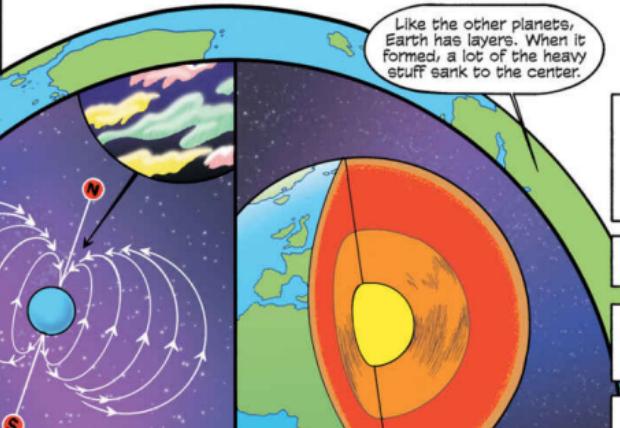
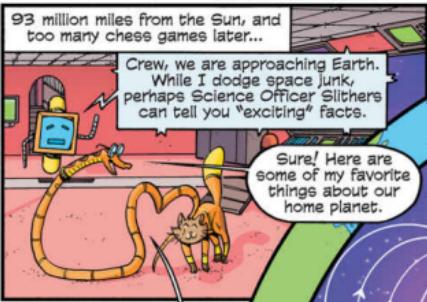


Visits from Earth Spacecraft:
We've made many unpiloted flybys, orbits, and landings. In 1966, *Venera 3* was the first spacecraft to (crash) land on another planet. Most of our info comes from orbiters such as *Magellan* that peek through the clouds with radar.

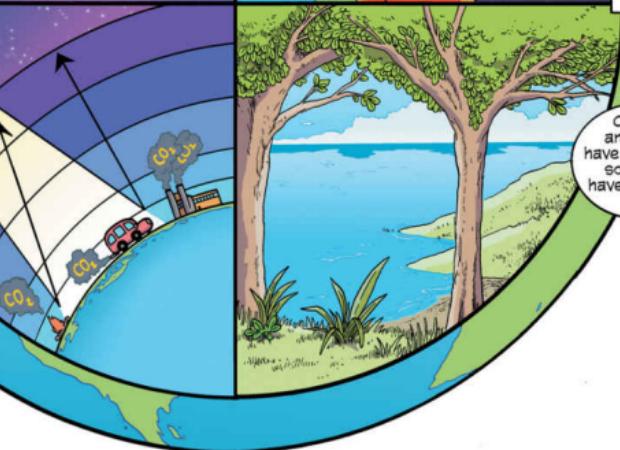




PART 6: EARTH



When particles streaming from the Sun hit the magnetic field, you get those beautiful northern and southern lights, also known as the aurora borealis and aurora australis.



Like the other planets, Earth has layers. When it formed, a lot of the heavy stuff sank to the center.

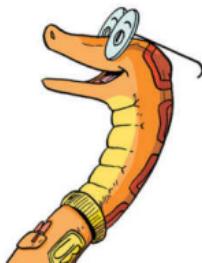
INNER CORE
A solid ball that's mostly two metals, iron and nickel. It's as hot—or hotter—than the surface of the Sun! (Roughly half of the heat is left over from the Earth's formation.)

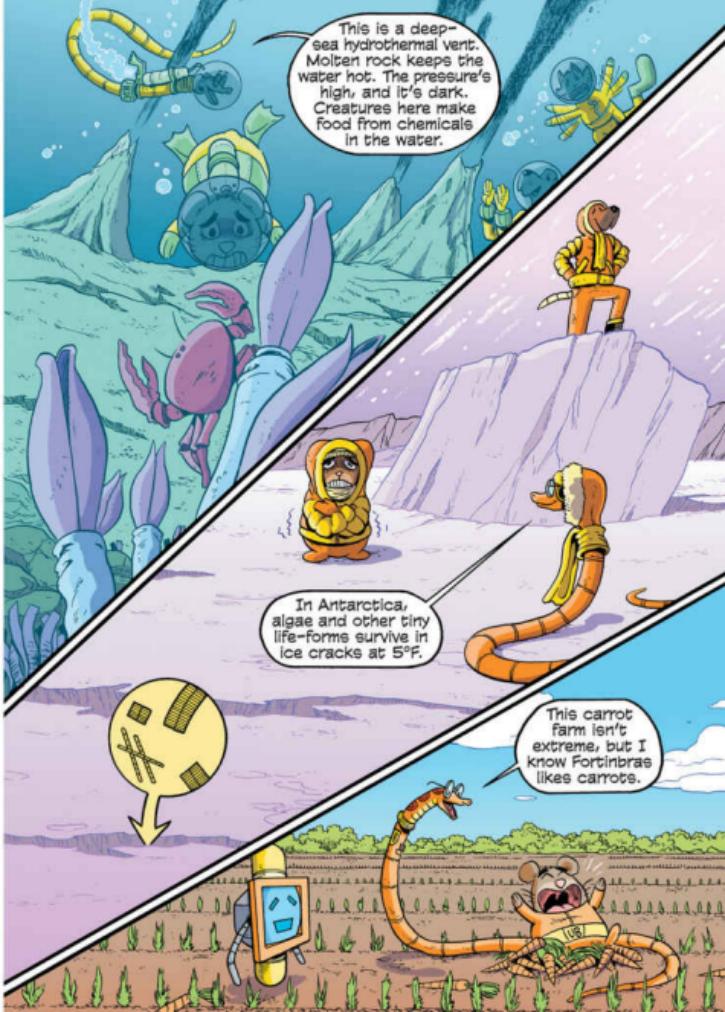
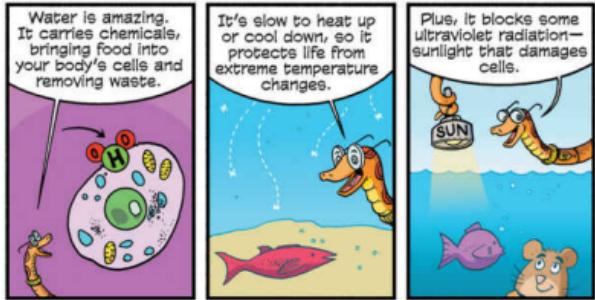
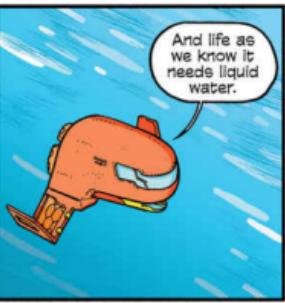
OUTER CORE
Mainly liquid iron and nickel.

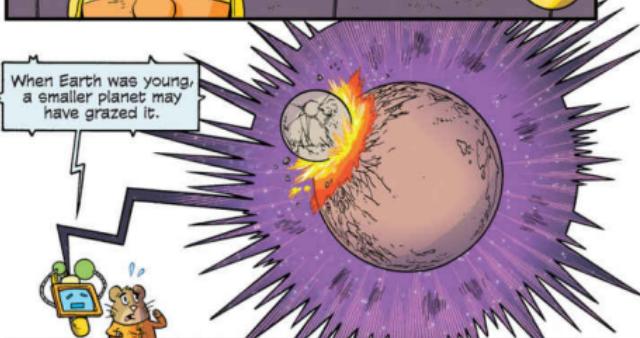
MANTLE
It flows verrrry slowly, causing the crust above—and its continents—to move around.

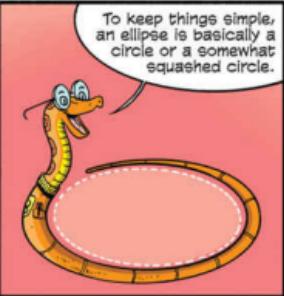
CRUST
A thin, rocky layer. This is where we live!

Other planets have layers and atmospheres, and many have magnetic fields. But there's something on Earth that we haven't yet found anywhere else in our Solar System...









EARTH: A REPORT



Size: 7,917.5 miles in diameter—more than 3 times wider than the Moon (2,159.2 miles).

Contents: A solid-metal inner core, a liquid-metal outer core, a rocky flowing mantle, and a thin stiff crust, plus an atmosphere that keeps us nice and toasty.

EARTH'S PLACE IN SPACE



Amazing Features



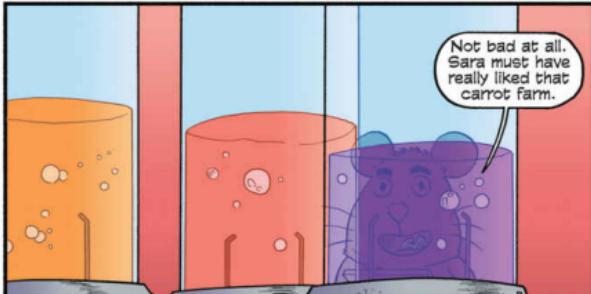
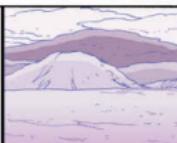
Liquid water, which is important for life.



The Moon, plus all sorts of satellites built by people, including the International Space Station!

Important Note:

Earth is the only place in the Solar System where we've found life. It exists in many extreme places, such as deep-sea hydrothermal vents, ice cracks in Antarctica, and tasty carrot farms.



PART 7: MARS

141.6 million miles from the Sun...

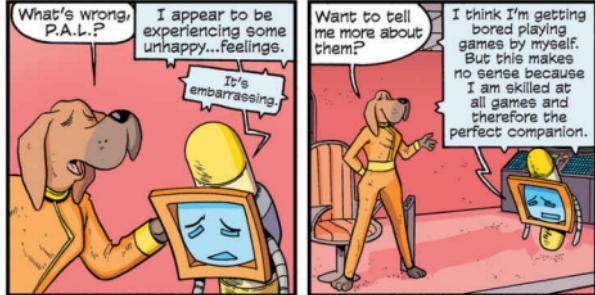


Crew, we are approaching the planet Mars. It's named for the ancient Roman god of war, perhaps because it is red and reminded people of blood.

But that's illogical: it's red because it's covered in rusted iron dust.



sight

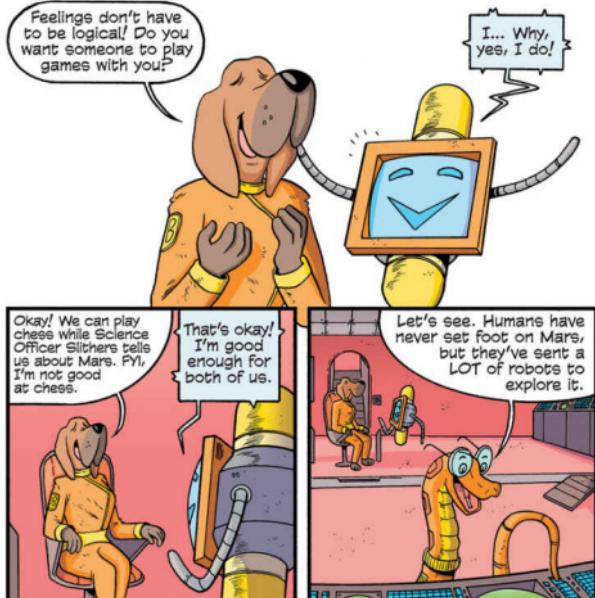


What's wrong, P.A.L.?

I appear to be experiencing some unhappy...feelings.
It's embarrassing.



Want to tell me more about them?
I think I'm getting bored playing games by myself. But this makes no sense because I am skilled at all games and therefore the perfect companion.

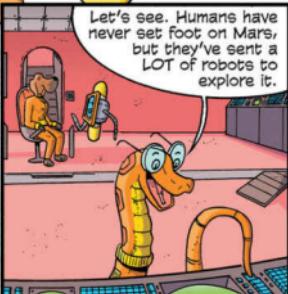


Feelings don't have to be logical! Do you want someone to play games with you?

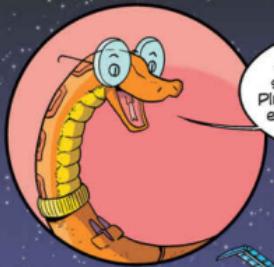
I... Why, yes, I do!

Okay! We can play chess while Science Officer Slithers tells us about Mars. P.YL, I'm not good at chess.

That's okay! I'm good enough for both of us.



Let's see. Humans have never set foot on Mars, but they've sent a LOT of robots to explore it.



From the 1960s onward, they've launched dozens of spacecraft toward Mars. Not all were successful. Space travel is dangerous. Plus, it involves a lot of complex math and engineering, and sometimes people make errors when they're building or flying spacecraft.



NASA's Mariner 4
Launched: 1964
In 1965, it made the first flyby of Mars and took pictures.



NASA's Mars Climate Orbiter
Launched: 1998

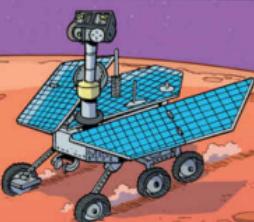
Some people forgot to convert imperial units to metric. Because of this math mistake, the orbiter accidentally entered Mars's atmosphere and broke apart.



The Indian Space Research Organization's Mars Orbiter Mission
Launched: 2013
It arrived at the planet in 2014, making India the first nation to reach Mars on the first try!

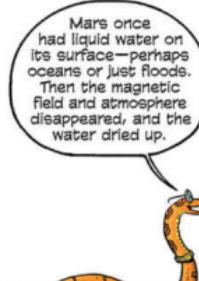
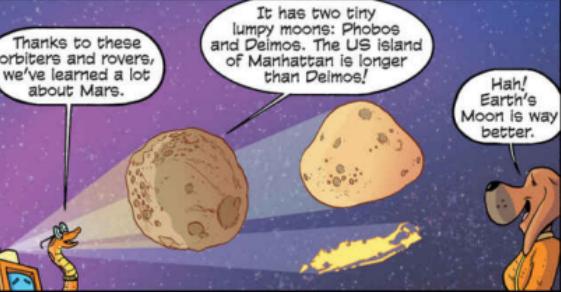


And we've successfully landed four rovers on the surface to study Mars up close! Here's one of them...

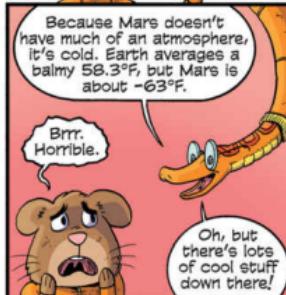


NASA's Opportunity
Launched: 2003

It reached Mars in 2004 and is still exploring. With its help, we've discovered meteorites on the surface, found evidence of past flowing water, and much more.



Mars once had liquid water on its surface—perhaps oceans or just floods. Then the magnetic field and atmosphere disappeared, and the water dried up.

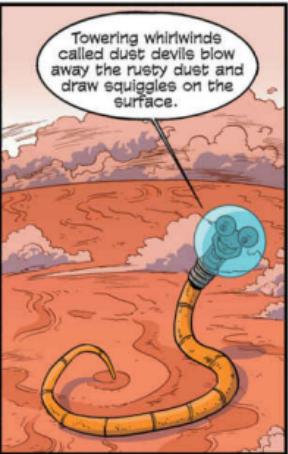
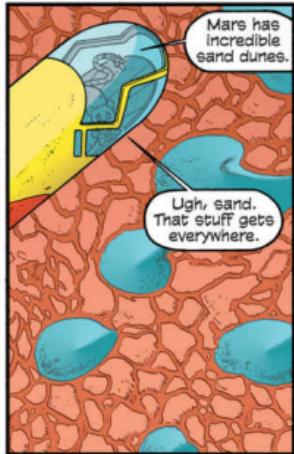


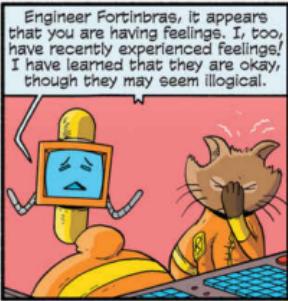
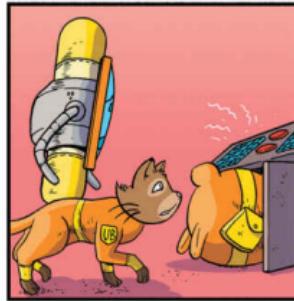
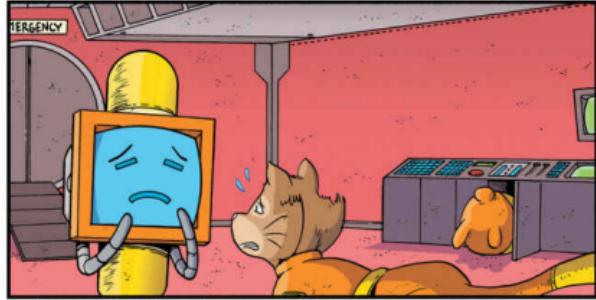
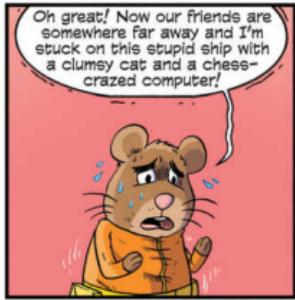
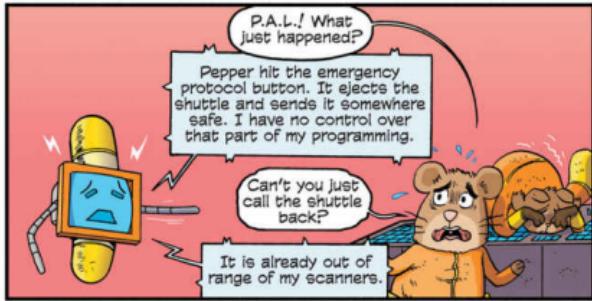
Because Mars doesn't have much of an atmosphere, it's cold. Earth averages a balmy 58.3°F, but Mars is about -63°F.

Brrr. Horrible.

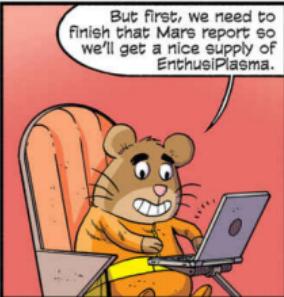
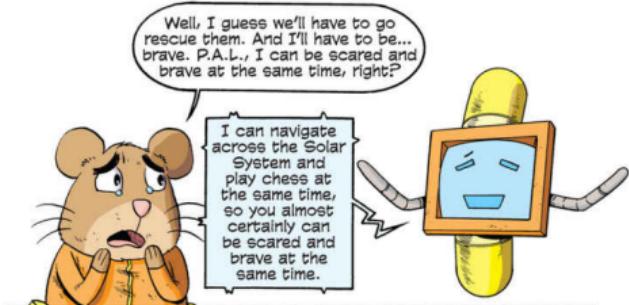


PART 8: LEAVING MARS & ASTEROID BELT





MARS: A REPORT



Origin of Name: The ancient Roman god of war and agriculture.

Size: 4,212 miles across—just a little more than half the width of Earth.

Contents: An iron (possibly partly liquid) core, a rocky mantle, and a crust, plus a thin atmosphere.

MARS'S PLACE IN SPACE



Amazing Features



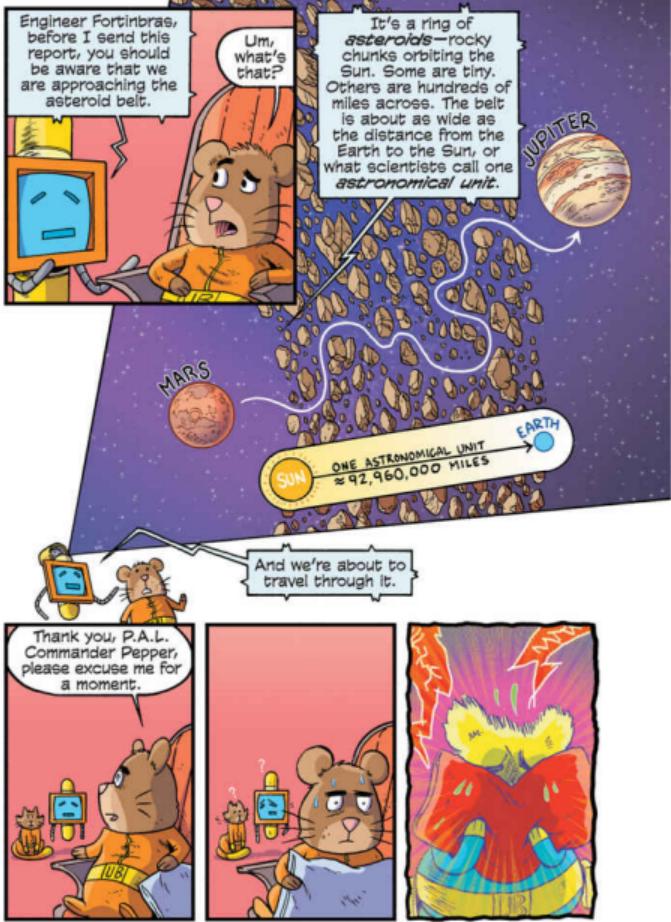
Olympus Mons, the largest-known volcano in the Solar System.

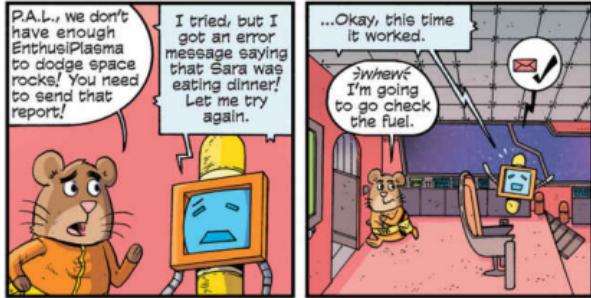
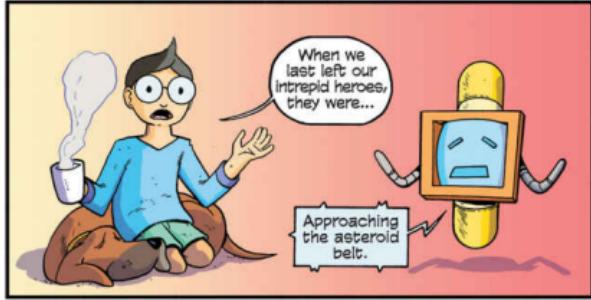


Valles Marineris, a huge canyon.

Visits from Earth Spacecraft:
Many! People have been launching spacecraft at Mars since the 1960s. There have been flybys, orbiting and landing spacecraft, and rovers—dozens of craft in all!

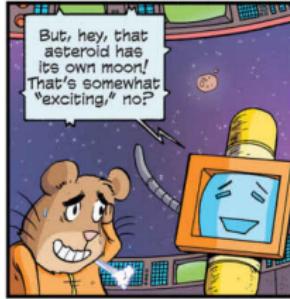








Large asteroids are millions of miles apart, so the belt is mostly empty space.



Oh dear.

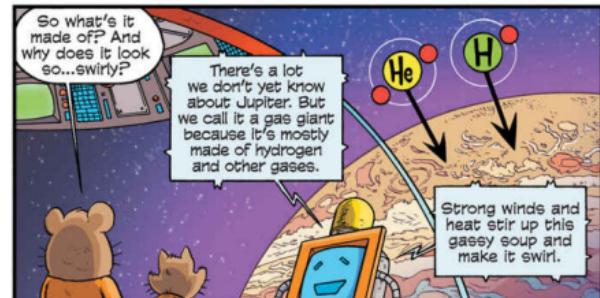
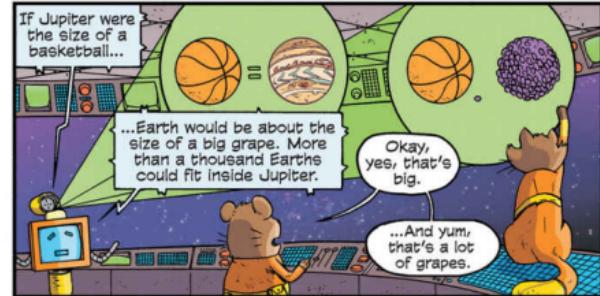
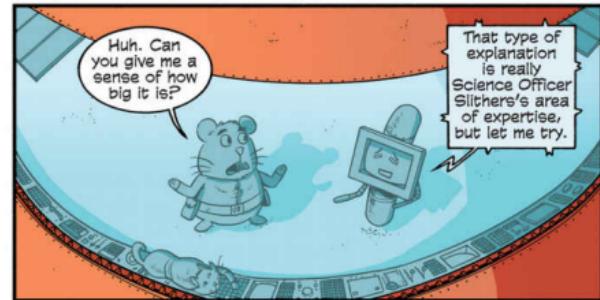


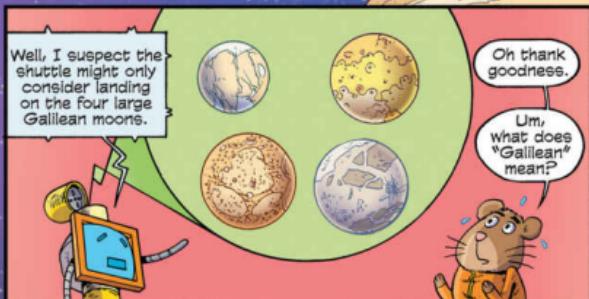
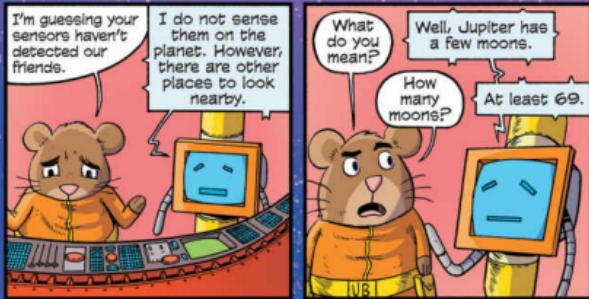
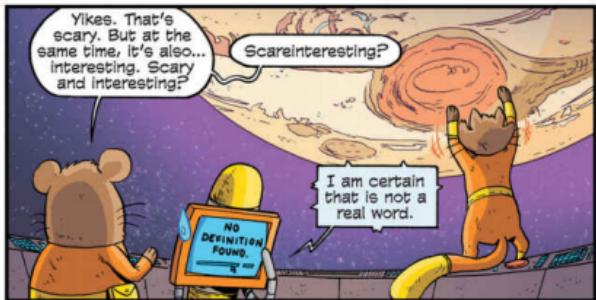
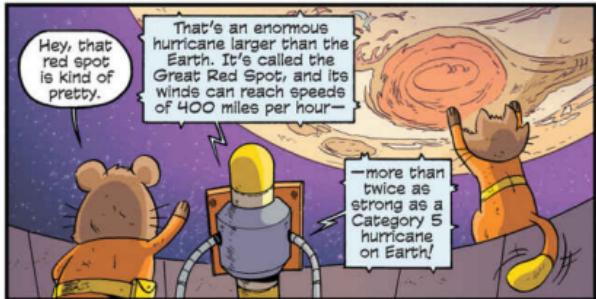
PART 9: JUPITER

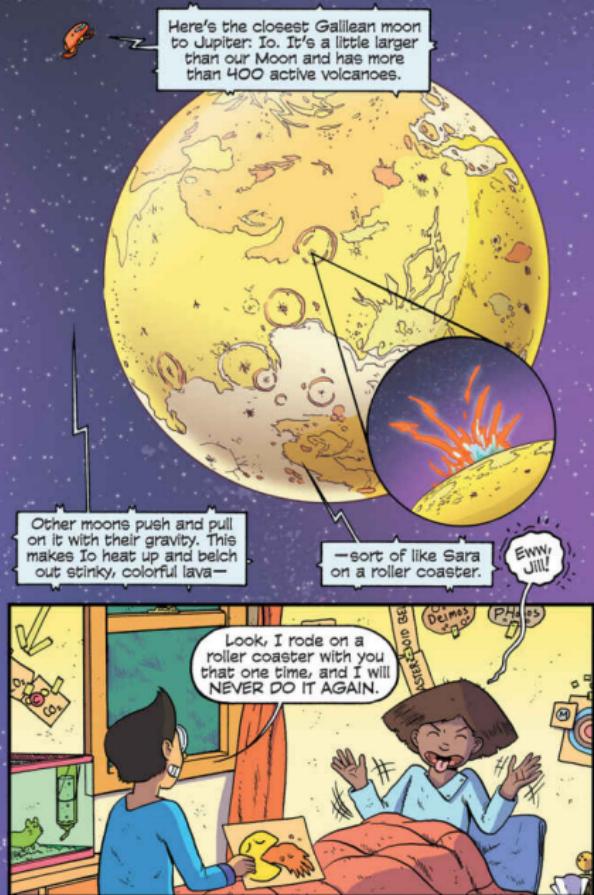
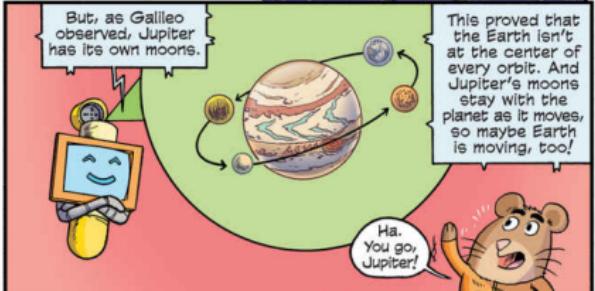
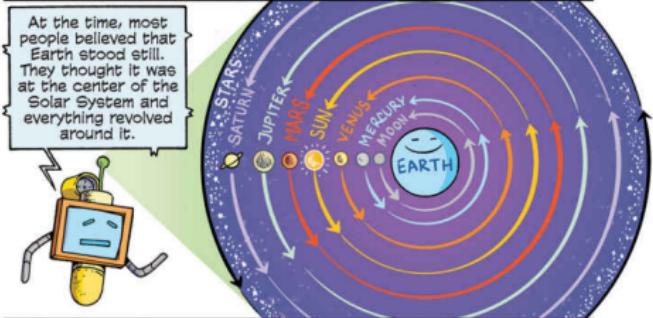
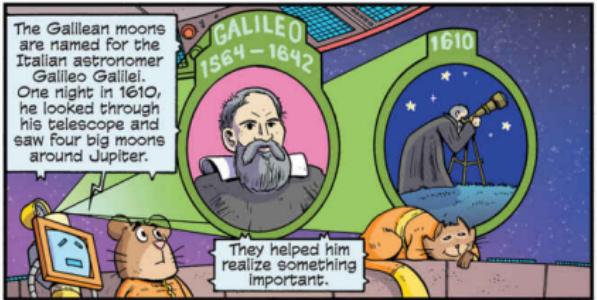
483.8 million miles from the Sun...



Welcome to Jupiter. The ancient Romans named this planet after their most important god, and that's not surprising, because Jupiter is the largest planet in our Solar System.







This is Europa.

It's a little smaller than our Moon—but it has more water than all of Earth's oceans.

There's liquid water below the frozen surface, kept warm by the gravitational push and pull from the other moons.

As the water sloshes around, it creates those cracks in the surface.

Liquid water? Could that mean it has life?

Possibly!

Ooooh.



Ganymede is the biggest moon in the Solar System. It probably has salty oceans below its surface.

And finally, meet Callisto. It's bigger than our Moon, and it's the most heavily cratered satellite in our Solar System.



It's the only moon with a liquid iron core that makes a magnetic field—and it has auroras!



It may also have a salty ocean.

These moons are all so unique.

I have a feeling that Sara is going to like our report.



JUPITER: A REPORT



Origin of Name: The ancient Roman king of the gods.

Size: 86,881.4 miles wide. More than 1,300 Earths could fit inside Jupiter!

Contents: There's a lot we don't know about Jupiter's insides. The core is a mystery. Above it is metallic hydrogen (gas under so much pressure that it behaves like a metal), then liquid and gaseous hydrogen and other gases.

JUPITER'S PLACE IN SPACE



Amazing Features



The Great Red Spot, a scaryinteresting hurricane.



At least 69 confirmed moons. Some have liquid water, which could mean they have life! Io, one of the weirdest, looks like a pizza gone bad.

Visits from Earth Spacecraft:

Starting in the 1970s, several spacecraft flew past Jupiter, and a couple have orbited it. None landed on the surface (because there might not even be one!).



A planet as beautiful as socks? That's high praise!



Whew! That's plenty of fuel. We can do this.



P.A.L., let's head to the next planet. We're going to find our friends and I'm going to keep being scared but brave!



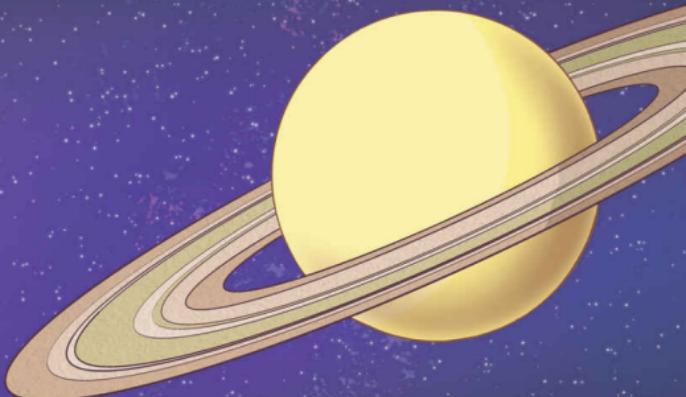
Meow!

Meanwhile, back on the shuttle...



PART 10: SATURN

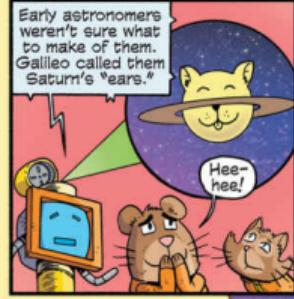
888.2 million miles from the Sun...



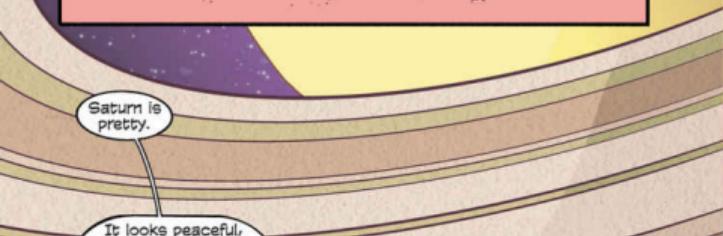
Crew, we are approaching Saturn, another gas giant. It's the second-largest Planet in our Solar System.



As you can see, it has a lot of rings around it.

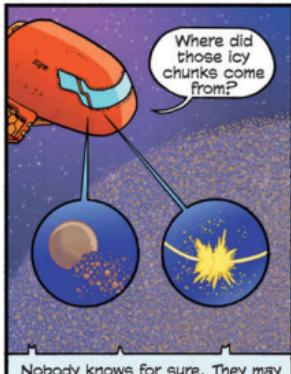


But if you look closely, you'll see that they're a thin layer of mostly water ice with a little bit of rock and dust.

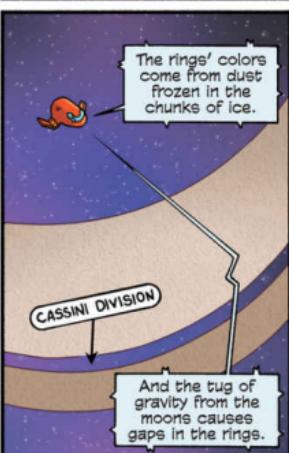


It looks peaceful, but from what I've learned about the other planets, I'm guessing it's...a whirlwind of drama?



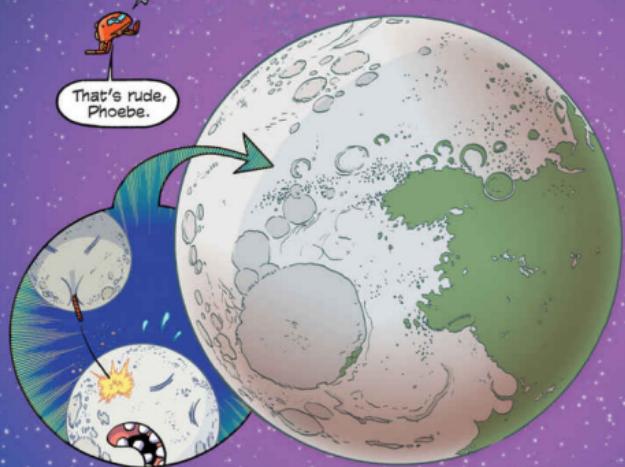


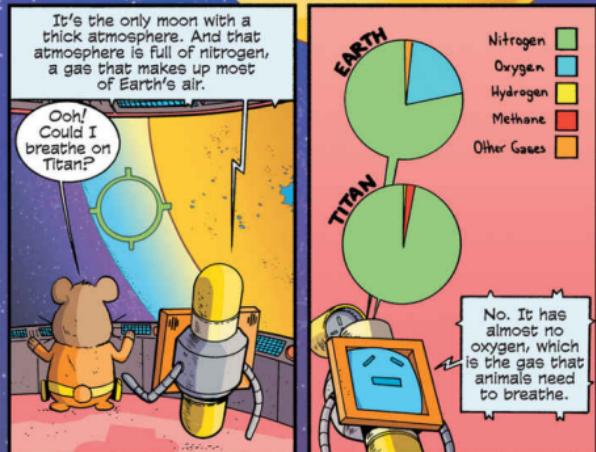
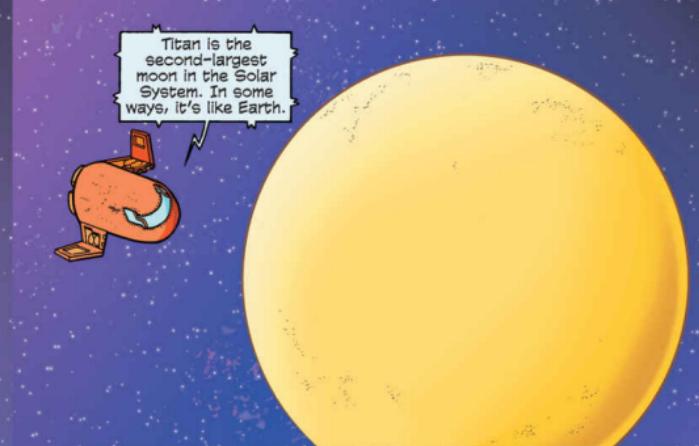
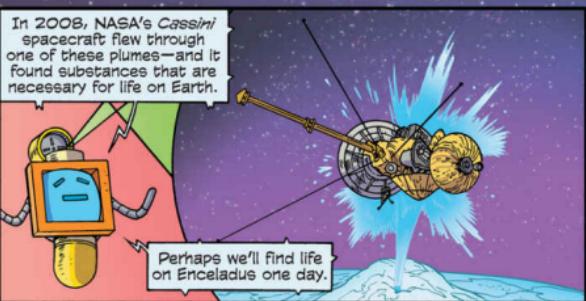
Nobody knows for sure. They may be pieces of moons or passing asteroids torn apart by Saturn's gravity. Debris streaming off nearby moons helps add to the rings.



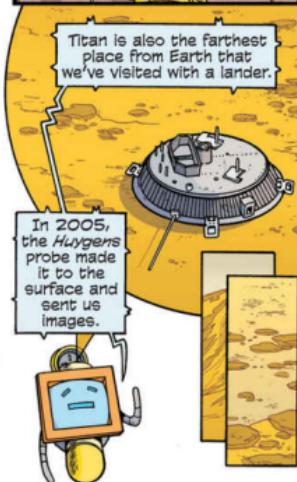
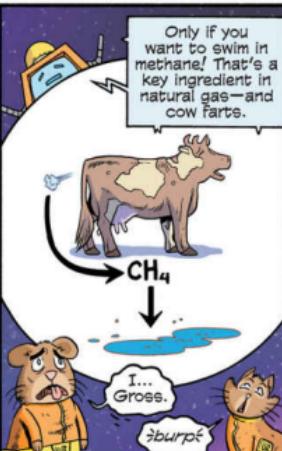
But only a few of them are large enough to catch our shuttle's interest. Here are some of my favorites.

Iapetus is really bright on one side, and really dark on the other. It gets hit by debris that streams hit by debris that streams from another moon, Phoebe.





SATURN: A REPORT



Origin of Name: The ancient Roman god of agriculture.

Size: 72,367.4 miles across. 764 Earths could fit inside Saturn.

Contents: There's a lot we don't know about Saturn's interior. Scientists figure it's similar to Jupiter, with metallic hydrogen below gaseous and liquid hydrogen (and some other gases, too).



Amazing Features

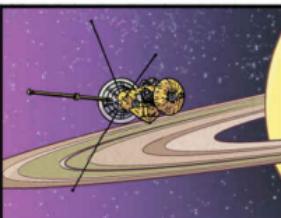


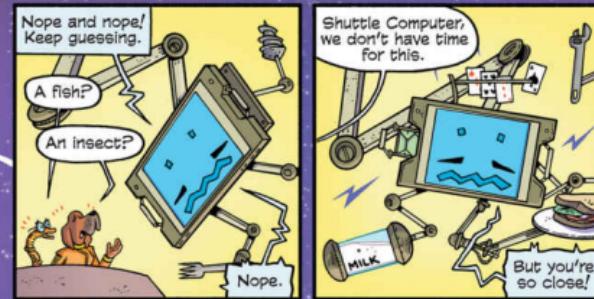
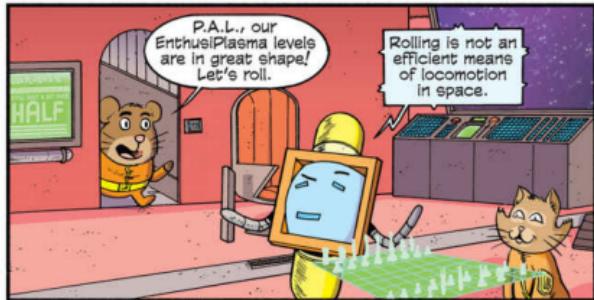
A beautiful system of rings.



More than 60 moons. One of them, Titan, has lakes and a thick atmosphere.

Visits from Earth Spacecraft:
A few spacecraft have flown past Saturn. The Cassini-Huygens space probe orbited Saturn in 2004 and Huygens landed on Titan in 2005.





PART 11: URANUS

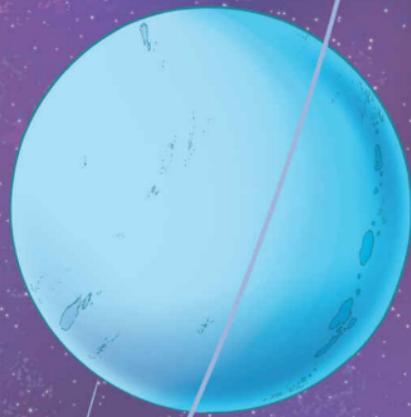
1.787 billion miles from the Sun...

We've arrived at our seventh planet: Uranus.



Because it's so far away and hard to see from Earth, Uranus wasn't officially discovered until—

—Pepper, drop that pawn!



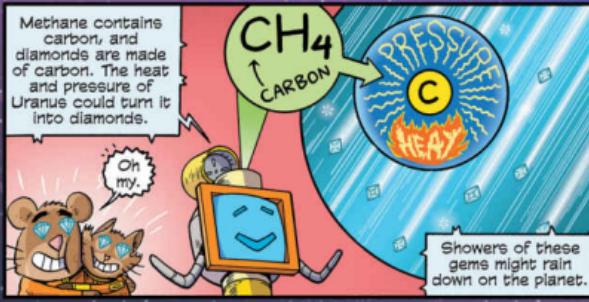
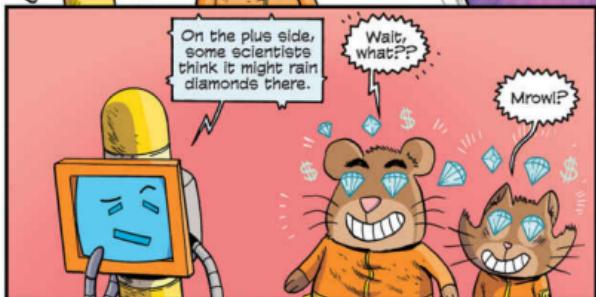
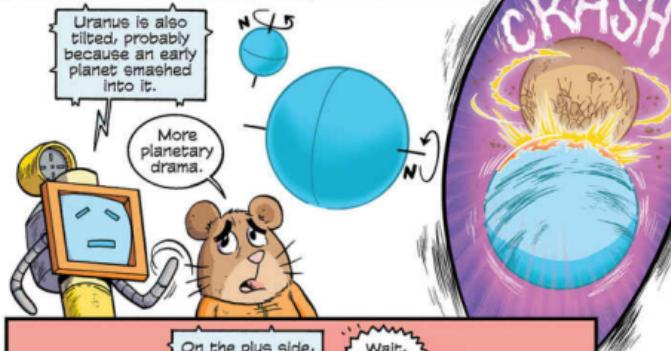
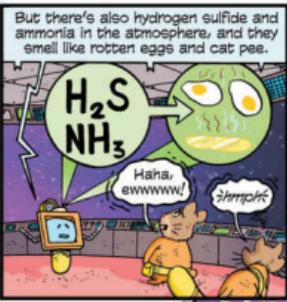
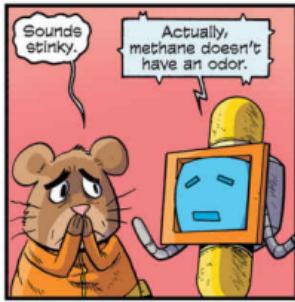
He wanted to name it Georgium Sidus—George's Star—after England's King George III. But everyone thought that sounded awful, so it was named for the Greek sky god.

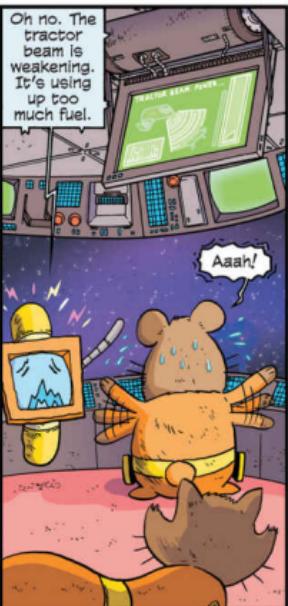
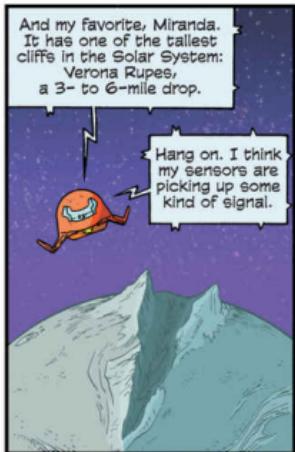


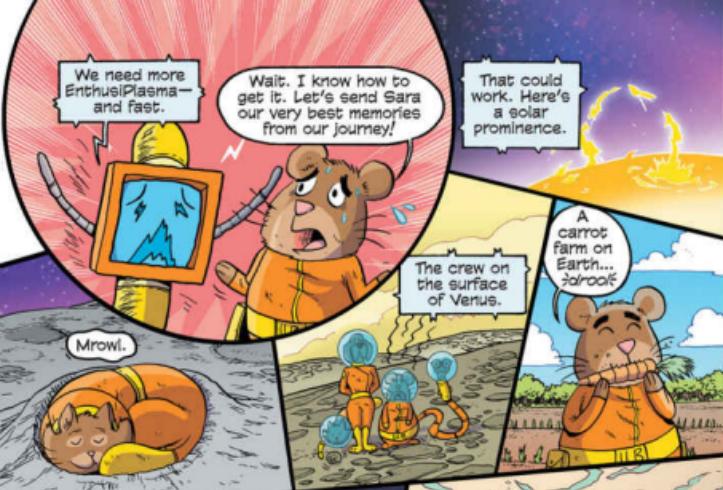
Why is Uranus so blue? It's pretty.

There's methane in the atmosphere, and it absorbs just the red parts of sunlight, so we see blues and greens.











URANUS: A REPORT



Origin of Name: The ancient Greek god of the sky.

Size: 31,518 miles across, nearly four times wider than Earth.

Contents: A rocky core; a mantle of water, ammonia, and methane; and an atmosphere of hydrogen, helium, and methane.

URANUS'S PLACE IN SPACE



Amazing Features



Stunning blue color because of methane.

Uranus has 27 known moons. Miranda has a very, very tall cliff, and was the site of the Great Space-Pets Reunion.



**Visits from Earth
Spacecraft:**
Only one: Voyager 2 flew past Uranus in 1986.
There's a lot more for future explorers to discover!



PART 12: NEPTUNE

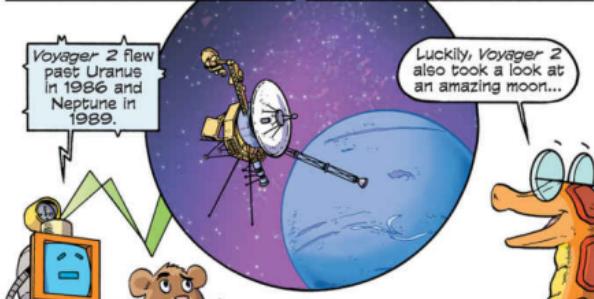
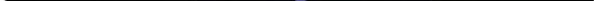
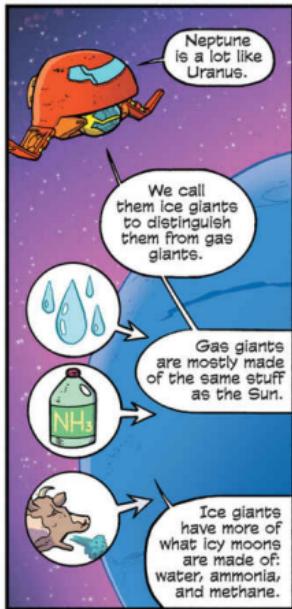
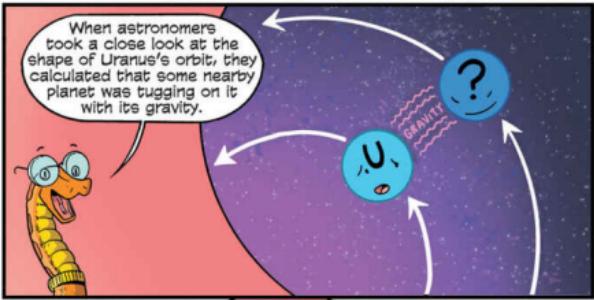
2.795 billion miles from the Sun and several excellent chess games later...

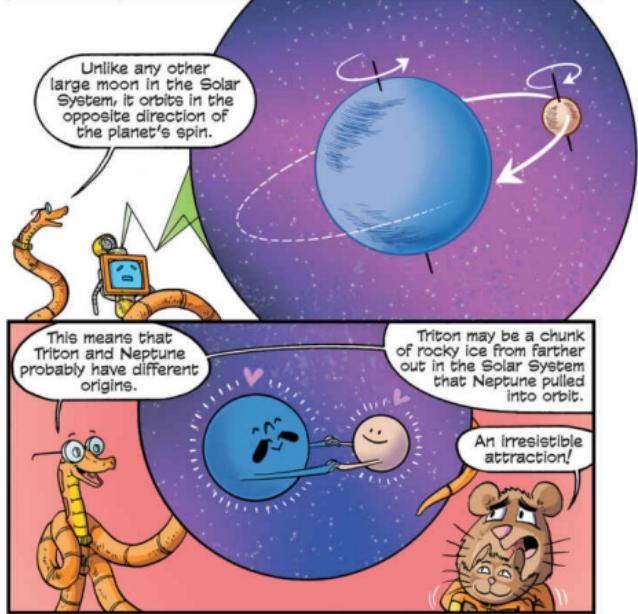
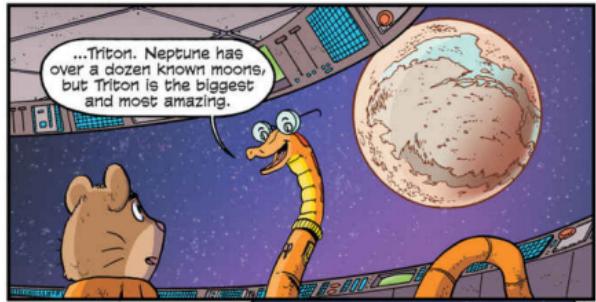


Crew, we've arrived at our final planet: Neptune.

It's the only one that was discovered mathematically.







NEPTUNE: A REPORT



Origin of Name: The ancient Greek god of the sea.

Size: 30,599 miles across, nearly four times wider than Earth.

Contents: Like Uranus, Neptune has a rocky core; a mantle of water, ammonia, and methane; and an atmosphere of hydrogen, helium, and methane.

NEPTUNE'S PLACE IN SPACE



Amazing Features



The fastest wind speeds measured in the Solar System: 1,500 miles per hour! WHOOSH!

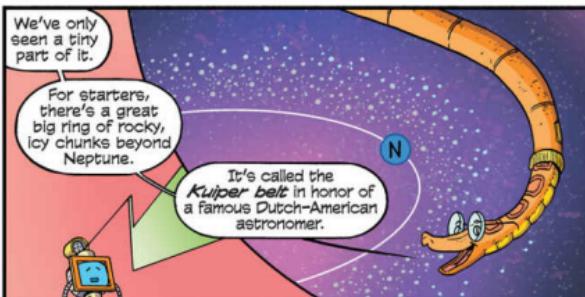


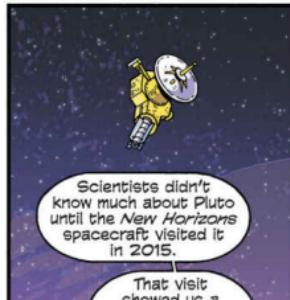
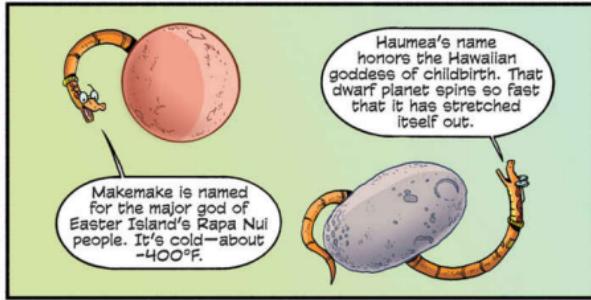
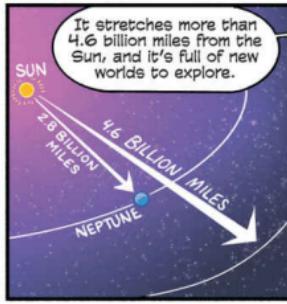
14 known moons. One of them, Triton, has geysers 5 miles high.

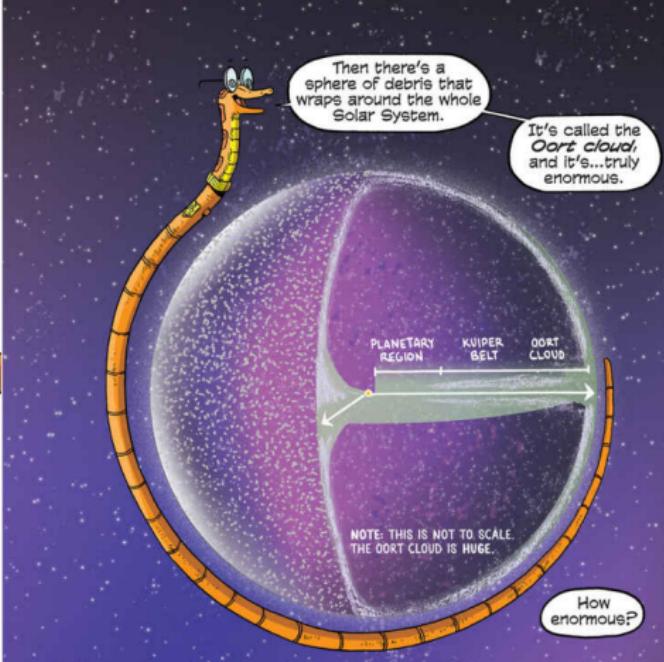
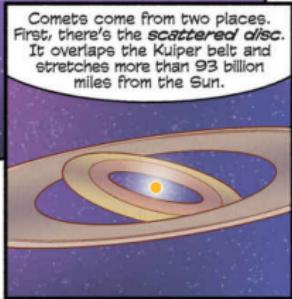
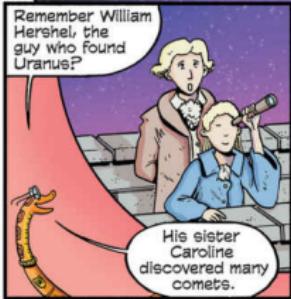
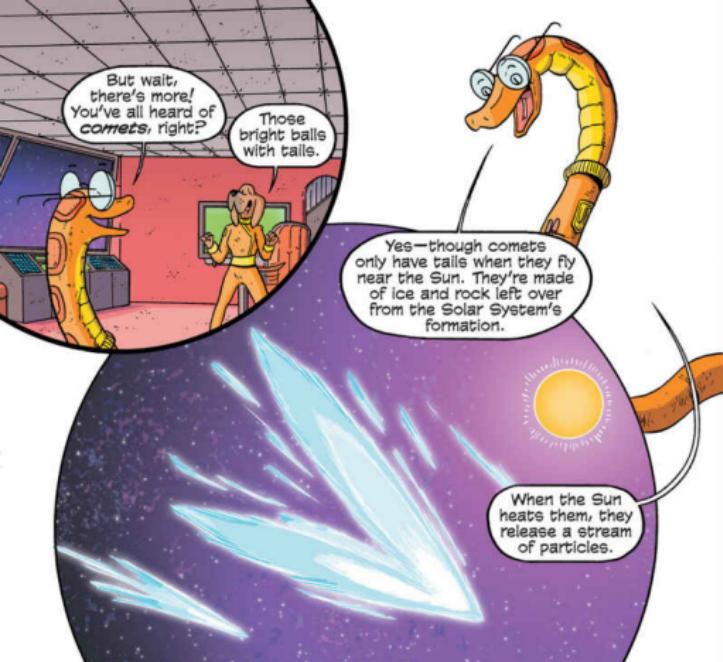
Visits from Earth Spacecraft:
Only one: Voyager 2 flew past Neptune in 1989.
This planet needs more exploration!

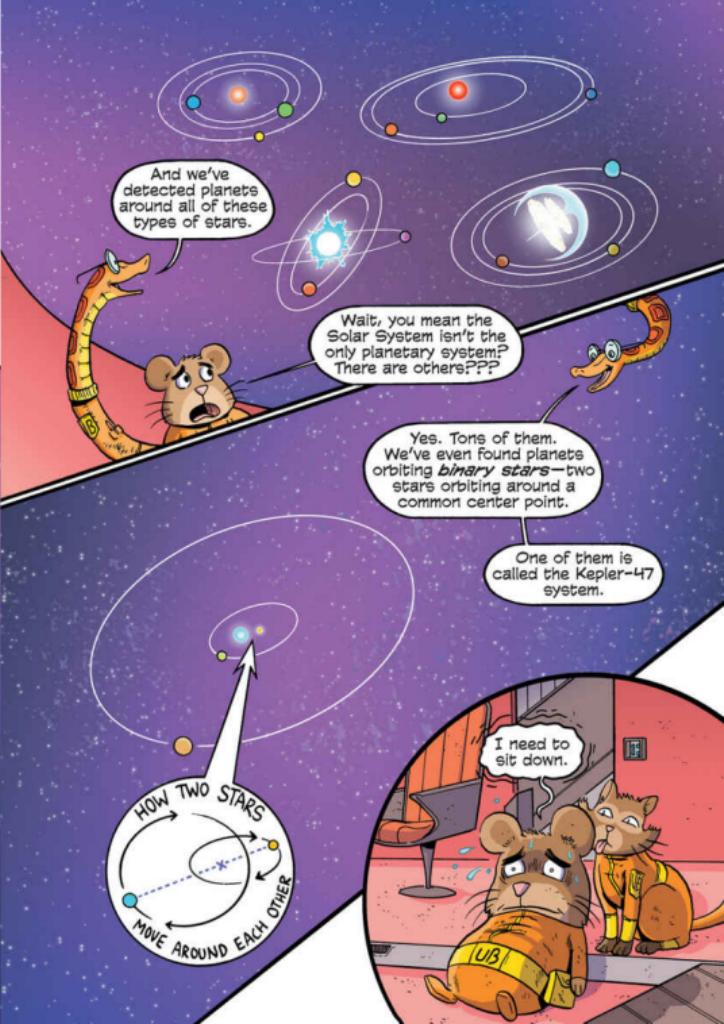
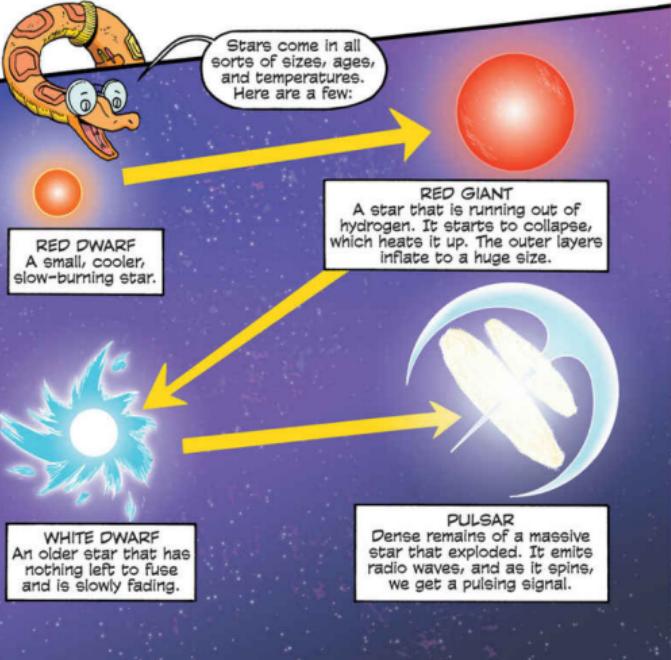


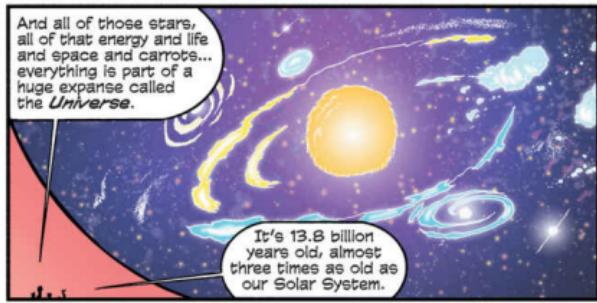
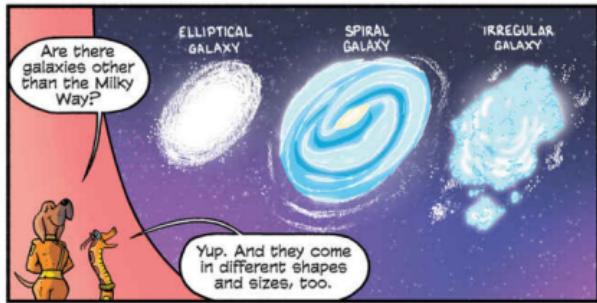
PART 13: BEYOND NEPTUNE

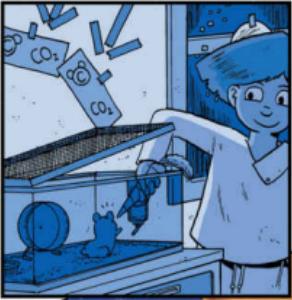
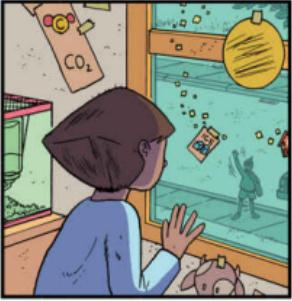


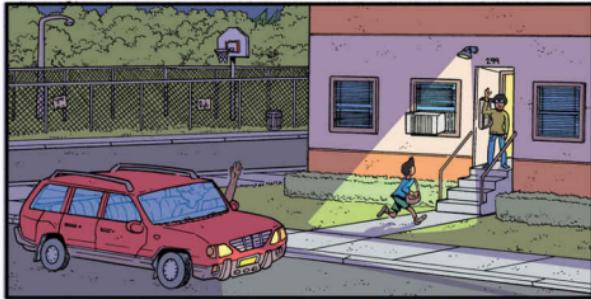












The Space Pets' Guide to Watching Meteor Showers

Meteors are small pieces of debris that hit the Earth's atmosphere, burning up and making a streak of bright light. People sometimes call them "shooting stars," but that's illogical: they're not stars falling from the sky.

Good. That would be bad for Earth.

During a meteor shower, you can see lots of streaks because Earth is passing through an area that's full of debris from a comet.

As comets get close to the Sun, they start to melt, and bits of rock and dirt fall off. This rubble hits our atmosphere and makes natural fireworks!

Here's a rough timetable that tells you when you can see some showers. Check online for the exact dates.

Quadrantids: January 3-4
Lyrids: April 21-22
Eta Aquarids: May 5-6
Perseids: August 12-13
Orionids: October 21-22
Leonids: November 17-18
Geminids: December 13-14

Look up in the night sky. Be patient—some showers are busier than others. You can see some meteors in the city, but if you can, try to get somewhere less bright.

Will a meteor hit me?

No!

Nearly all meteors are tiny and burn up completely. Rarely, meteors can land on Earth.

These are called meteorites, and they're a special find!





GO WHERE NO KID HAS GONE BEFORE WITH SOLAR SYSTEM!

Get up close and personal with Earth's nearest neighbors—Venus with its acid rainstorms, Saturn and its rings of ice, and the heart of it all, the Sun.

Reach for the stars!

SOLAR SYSTEM: OUR PLACE IN SPACE

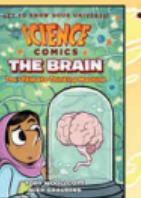
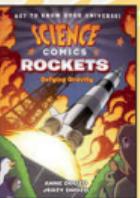
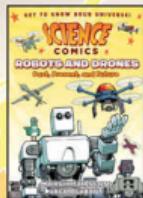
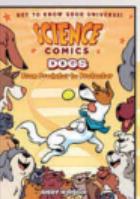
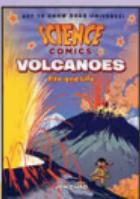
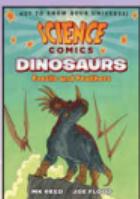
From early astronomers to NASA's first missions to rovers landing on Mars, humans have always been fascinated by outer space. And we're learning more about our Solar System every day. Did you know that our Solar System was born from a cloud of cosmic dust? That Jupiter's red spot is really a raging storm? Join Sara, Jill, and their space-faring pets on a quest to learn more about the wonders of our Solar System—and beyond!



:01

First Second
New York

Check out the whole series!



...And more coming soon!

GET TO KNOW YOUR UNIVERSE

SCIENCE COMICS SOLAR SYSTEM

Our Place in Space



SCIENCE COMICS

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JOHN
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