The Sun

and the places where it shines

A book about our solar system.

by Thea Kinyon

A Word from Chabot Space & Science Center

The mission of Chabot Space & Science Center has always been to “educate and inspire students of all ages about Planet Earth and the Universe.”

In 1883, Anthony Chabot donated an 8-inch refracting telescope to the people of the City of Oakland, California. That telescope, named “Leah,” is still in use today and still inspiring visitors, free of charge, just as Anthony Chabot originally intended.

Three research quality telescopes, hands-on science exhibits, instructive large-format films and a world-class planetarium are part of Chabot Space & Science Center’s tools utilized while making science a fun, family activity.

A portion of the proceeds of this book will go to continuing Chabot’s vision by contributing to education programs. Inspired by a visit to Chabot Space & Science Center, the author wishes to continue the tradition of educating students with her book, “The Sun and the Places Where it Shines.”

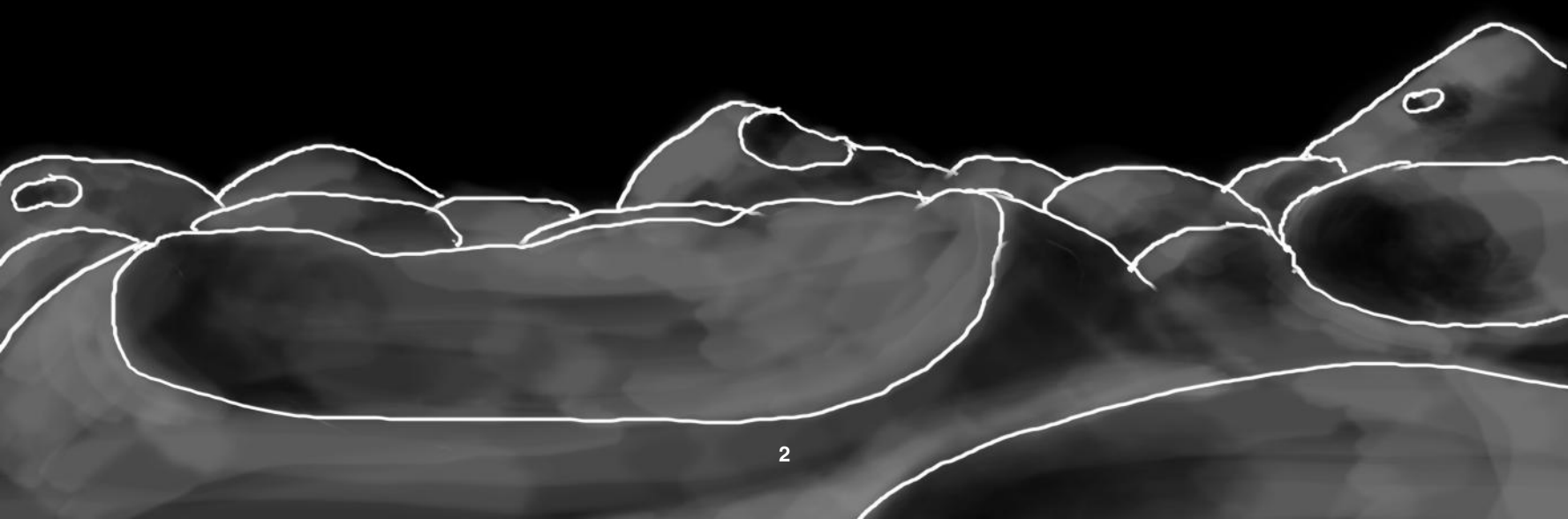
Chabot Space & Science Center thanks Thea Kinyon for her generosity and vision to help people better understand the Universe around them.

At the time of publishing in 2008, Chabot Space & Science Center celebrates 125 years of education and inspiration. In the next 125 years, humankind will see advances in the fields of space and science that we can’t even imagine. With your help, Chabot will still be here to help us understand them.
- Thea Kinyon

for my dad

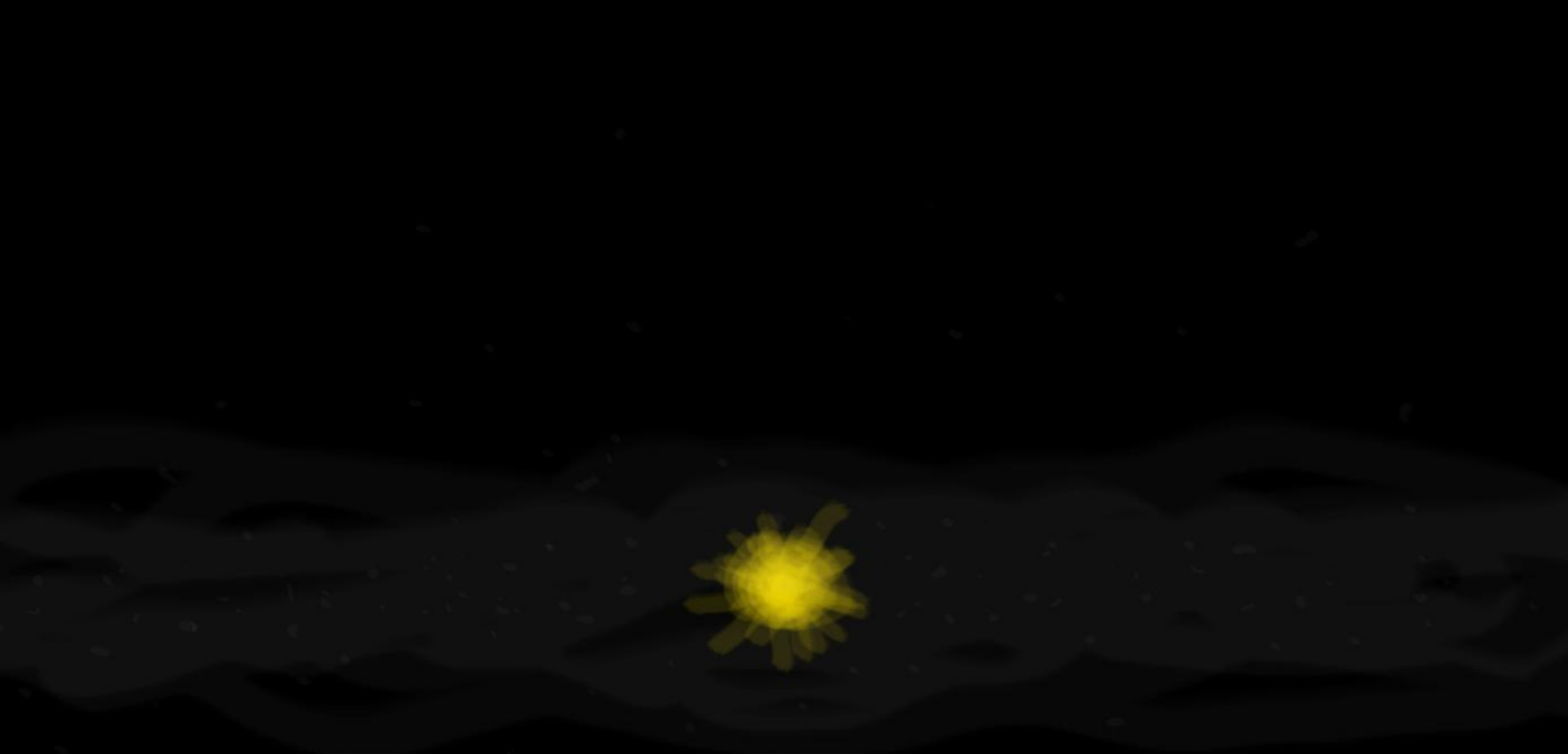

The sun.
Sometimes
it feels too
hot, or shines
too bright,
but without it,
the Earth would
be cold, dark,
and most
noticeably...

Dead.



The sun gives
us light, heat, and
life. Its energy is
absorbed by plants,
and plants make oxygen
for us to breathe.

The sun gives us electricity,
collected by solar panels, and
powers our cities and cars
through the plants it gave life
millions of years ago, that have
turned into oil and coal.
The sun can give you a
healthy glow or a painful
burn. It might put freckles
on your nose or highlights
in your hair. It's bright,
it's shiny, and compared
to our tiny planet,
it's really, really,
really big.



When the Sun was a baby star,
it was surrounded by dust, gas,
ice, and everything the Earth, moon,
and all the planets are made of.
Slowly, the planets formed.

Just like dust bunnies, or
tumbling tumbleweeds.

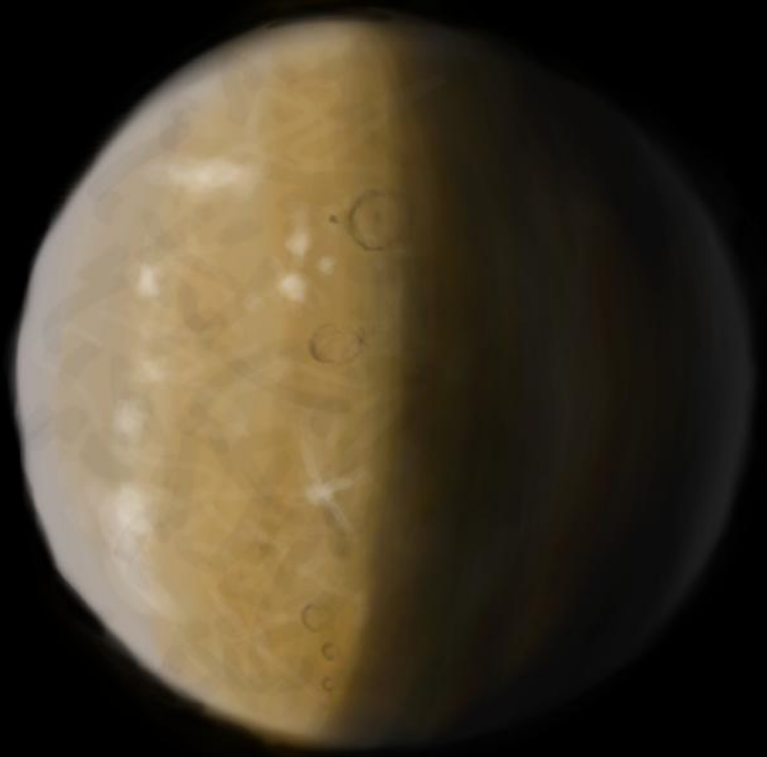

And our solar system was born.


With so much sunlight to give, is Earth the only place where the sun gives life, too?
Maybe.


Maybe not.
There are a lot of planets, and a lot of moons, and a lot of gas, dust, and ice.
And we're just barely starting to explore.

And every planet is different.

Like Mercury.



The planet closest to the sun. It only has three days every two years.

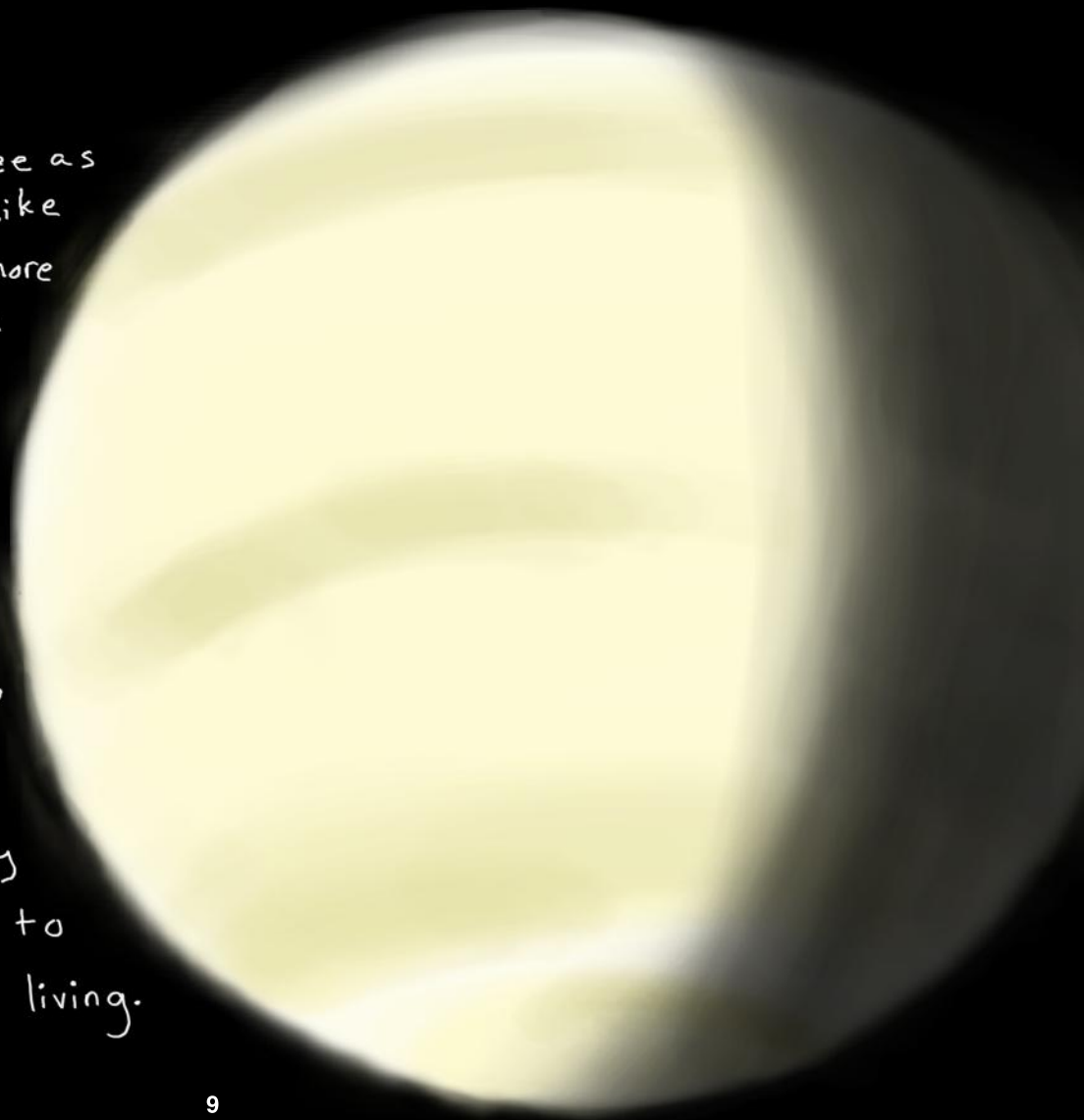
That makes for some very long days.

And very long, cold nights.

You would have to stay at dawn or dusk all the time, moving around the entire planet.

Fortunately, it's a small planet.

Venus is a little bigger.

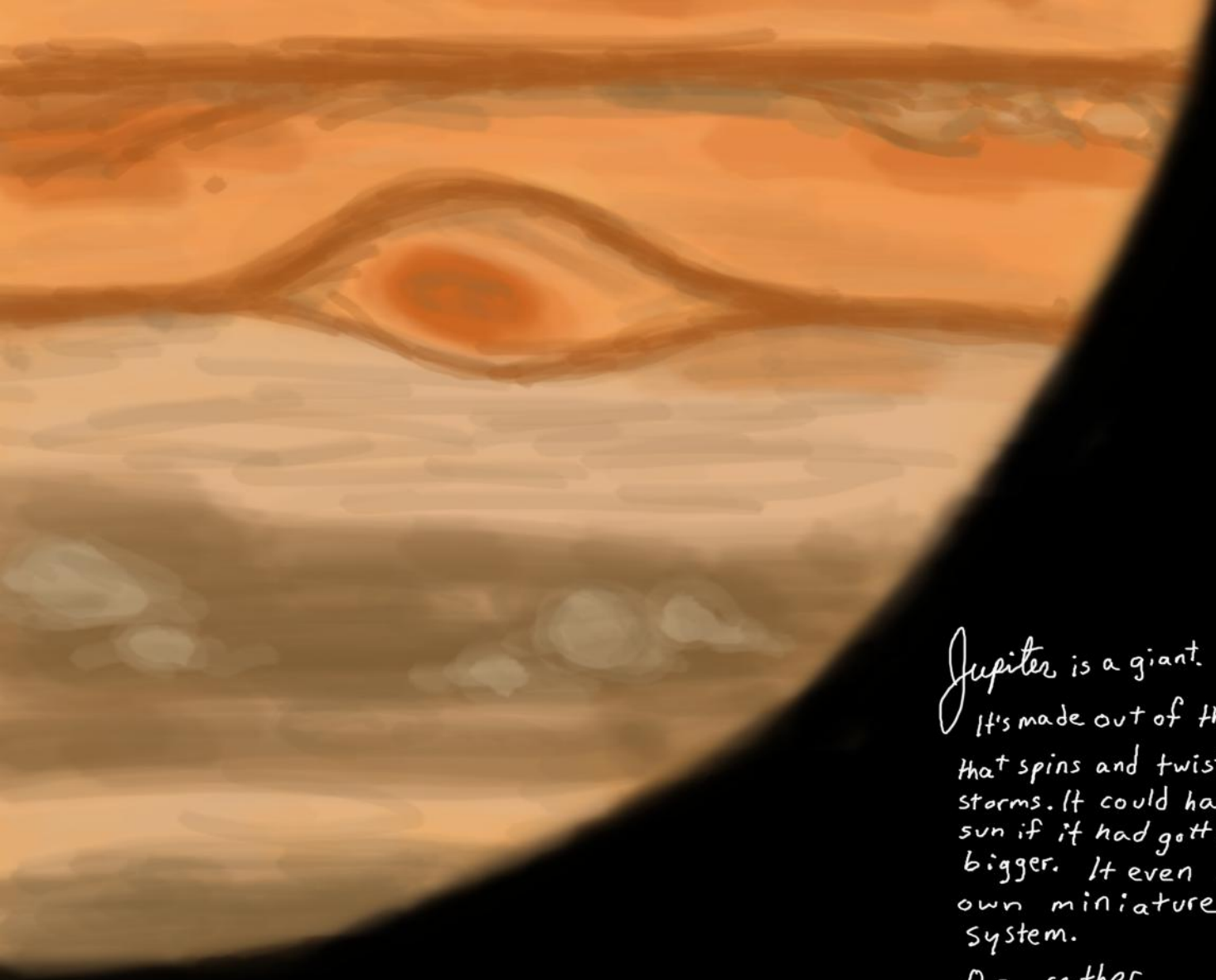


It's about the same size as Earth. It even has clouds like Earth, but it has a lot more of them. They cover the whole planet, all the time. They're like a big blanket keeping everything warm, even at night. Even at the north pole and the south pole.

As cozy as it sounds, it's too warm for living on.

At least the way we're used to living.

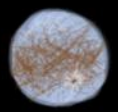

Mars is colder than Venus. It's colder than Earth, too, because it's farther away from the sun. It's covered with rust – that's why it looks like a red star in the sky. All the water on Mars is frozen — at least most of the time. It wasn't always that way, though. Mars might have looked more like Earth once upon a time. We've never found any life on the surface, but who knows what might be buried under all those rocks?

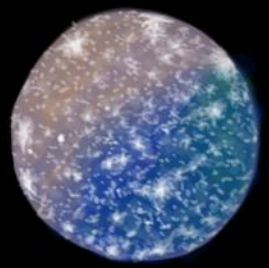


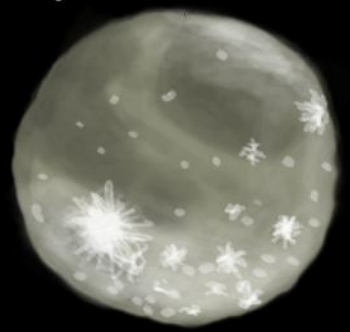
Jupiter is a giant.
It's made out of thick, hot gas that spins and twists in giant storms. It could have been a sun if it had gotten much bigger. It even has its own miniature solar system.
Or rather,
Jupiter System.

Some of Jupiter's moons are a lot like planets.

Io has lots of volcanos. 400 of them, maybe even more. They erupt all the time.







Europa, Callisto and Ganymede are icy moons with cold, barren surfaces. Under the ice, though, we might find great oceans. Even in the deepest, darkest oceans of Earth, life flourishes. Some of it doesn't even need the sun – it gets its energy from chemicals that well up from deep inside the Earth. We haven't found any reason why life wouldn't flourish in the oceans of these moons.

Saturn's rings can be seen with a normal telescope. They're made of gas, dust and rocks – all the stuff that formed the planets.

Saturn is a gas giant like Jupiter, and like Jupiter, it has its own system of moons that are a lot like planets.

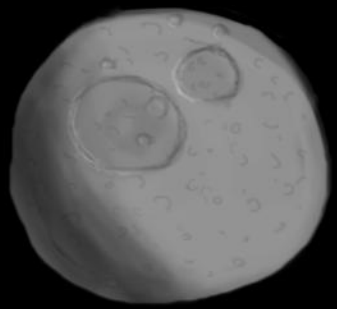
The Saturn System.


Titan
is a cloudy moon
just bigger than the planet
Mercury. It's clouds don't keep it warm like Venus's.
Instead, they keep it cool. Titan looks a lot like
Earth might have a long, long time ago.
At the very beginning of life.

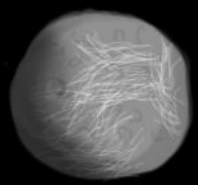
Mimas is tiny and shaped like an olive.

Iapetus has a giant ridge around its middle.

No one knows why.

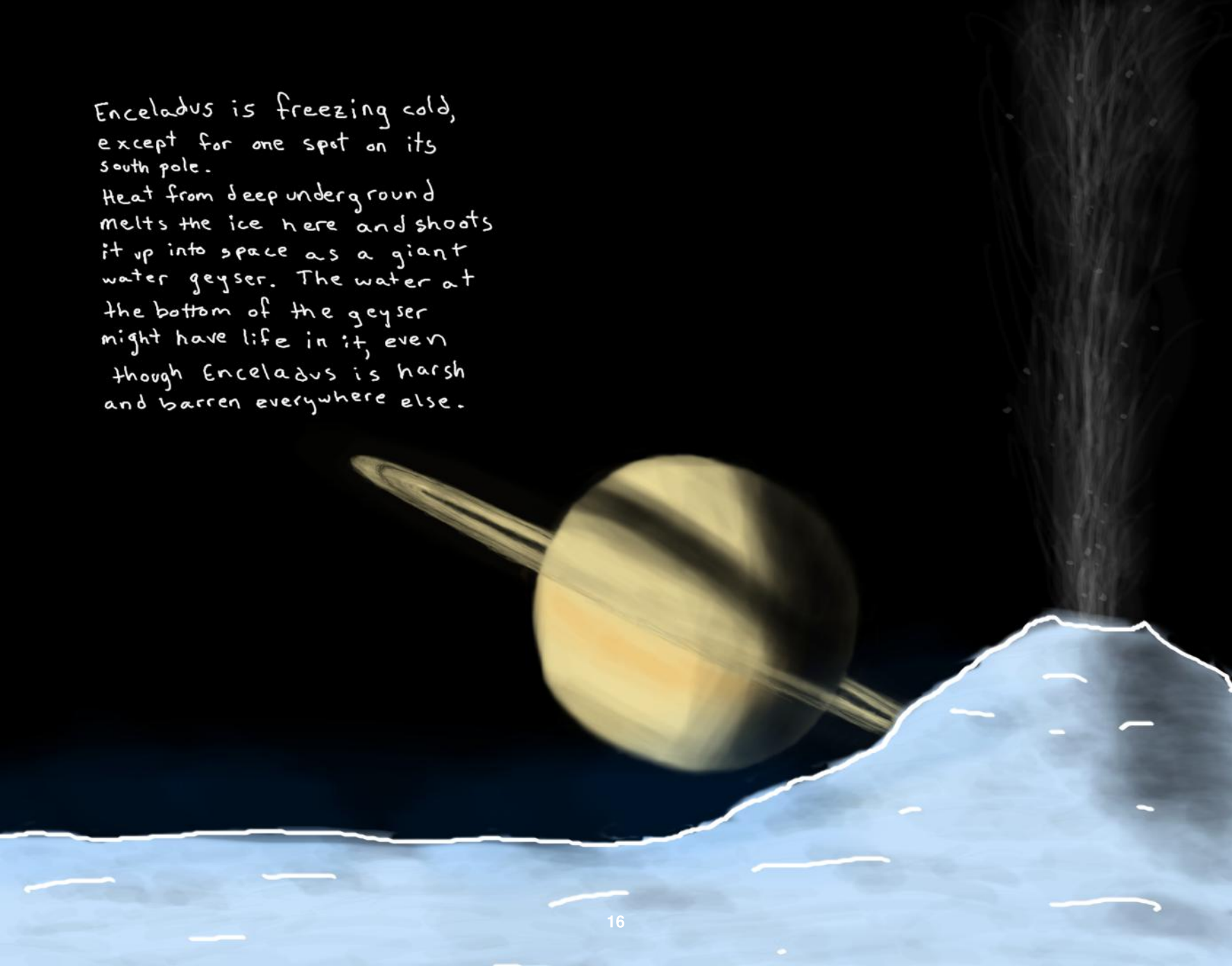


Rhea might have rings of its own. But we haven't actually seen them.



Dione is covered with tall cliffs made out of ice.

All of them are rocky and cold, a lot like our own moon, only smaller.


Enceladus is freezing cold, except for one spot on its south pole.
Heat from deep underground melts the ice here and shoots it up into space as a giant water geyser. The water at the bottom of the geyser might have life in it, even though Enceladus is harsh and barren everywhere else.

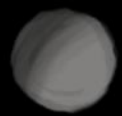

Uranus is a beautiful
blue giant.
It has thin rings,
and it spins sideways.
It has at least 27 moons,
all of them tiny
and cold.

Neptune is the farthest planet in our solar system. There might be a farther one, but no one has seen it. Neptune is the last gas giant. All of it's moons are tiny, except for Triton.

Triton was probably a dwarf planet long ago. We can tell because it goes backwards around its planet – something a natural moon would never do. The surface of Triton looks like a cantaloupe up close.

Dwarf planets are too small to be regular planets, but too big and round to be asteroids. They orbit the sun like all the other planets.

Ceres



Eris

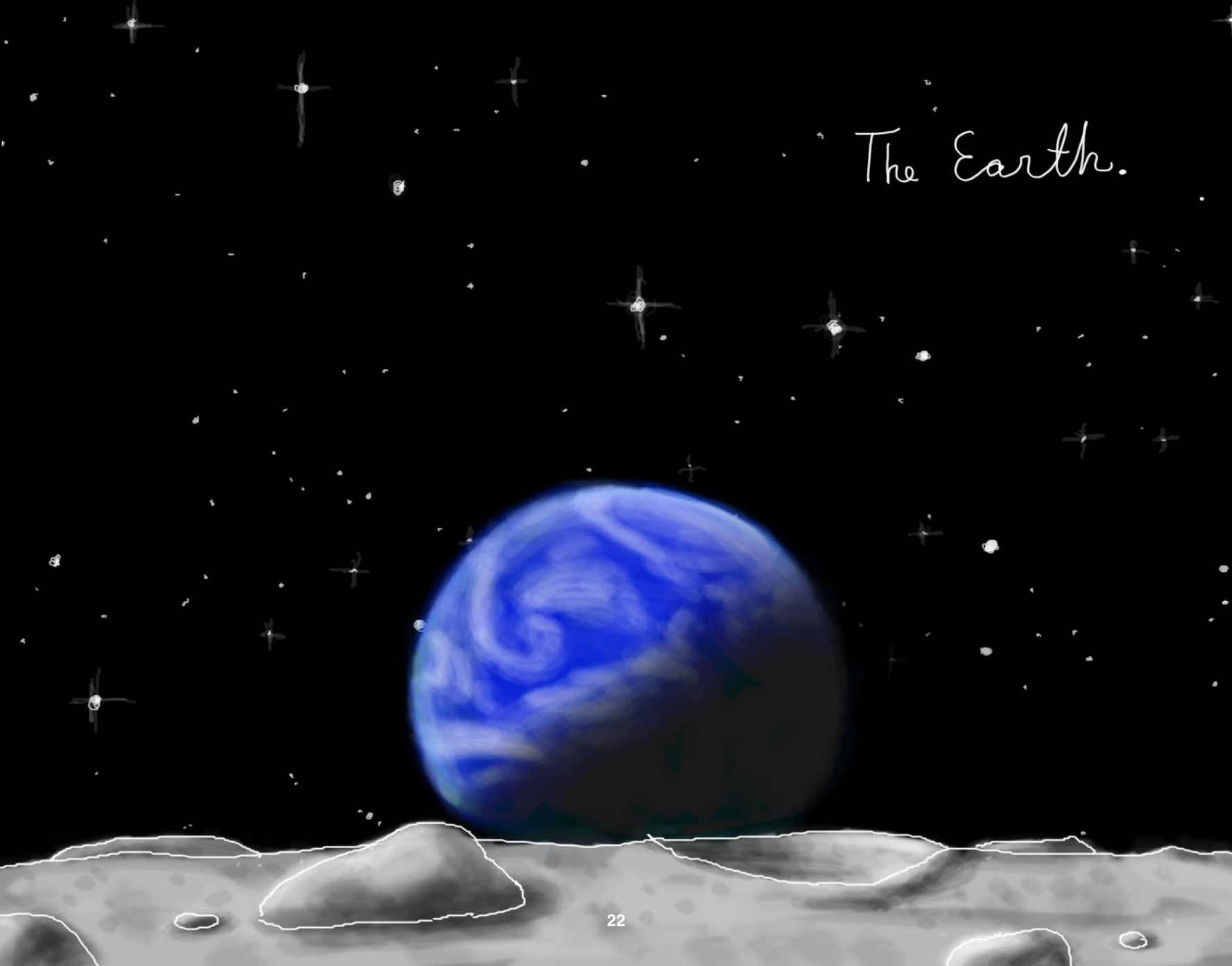
Ceres is between Mars and Jupiter. Pluto and Eris are far away, near Neptune.

Charon is more than just Pluto's moon. Instead of one orbiting the other, they orbit each other.

All of them are freezing cold.


Farther out, a cloud of dust and rocks
is all that orbits our sun.
The Oort Cloud.
From here, the sun is just like
all the other tiny,
twinkling
stars.


Of all the planets, dwarf planets, moons, and rocks, there's only one place that we know has life.


The Earth.


We have one moon, Luna
And we have oceans, rivers, lakes,
hills, mountains, geysers, beaches,
mesas, caves, canyons, plateaus,
dunes, villages, and cities —
all packed full of life.


Life undoubtedly exists somewhere else, either circling around our sun, or around another sun, in another solar system.
But for all of the life we know about, only Earth has everything we need to survive.
To keep it that way, we all need to take care of each other.


Every tree, every fish,
every insect, every person.
we are all completely unique
in the universe.
The
end.

Glossary

asteroid: A rock that is too small and lumpy to be a planet or a dwarf planet. If an asteroid collects a lot of dust and becomes big and round, it can turn into a planet, but it takes a really long time. The main difference between asteroids and comets is that comets have a trail of ice and dust coming off of them, called a tail.

atmosphere: The layer of air - usually a mixture of many different gasses - that surrounds a planet or moon. Earth's atmosphere is made mostly of the gasses oxygen, nitrogen, and carbon dioxide. Other atmospheres, like Titan's, have lots of methane or other gasses that humans can't breathe.

dwarf planet: A mini-planet that isn't big enough to be its own planet, and doesn't have its own orbit around the sun. For example, Pluto is sometimes closer to the sun than Neptune, and sometimes it's farther, because its orbit overlaps Neptune's. Dwarf planets also have to be big enough and round enough to be different from asteroids. For a long time, Pluto was considered a planet like all the others, but after scientists discovered Eris and Ceres, they made a new category for these tiny planets: dwarf planets. The new name might have been a step down for Pluto, but it was a step up for little Ceres and Eris.

gas: The stuff air is made of. It's lighter than liquids and solids, so it sits on the very outside of planets, on top of the heavier stuff. The layer of gas on the outside of planets is called an atmosphere. Any element can turn into a gas if it's at the right temperature - just like when you boil water and it turns into steam.

gas giant: A planet much larger than the Earth with an incredibly thick atmosphere. In fact, the whole planet is almost all gas, with just a tiny bit of solids in the center - if any.

geyser: A place where underground water is heated up so much that it bursts up through the ground, creating a pillar of water and steam. The most famous geyser on Earth is probably Old Faithful at Yellowstone National Park in Wyoming.

orbit: An orbit is the path that a planet follows around the sun. It's also the path that a moon follows around its planet - or any path that anything in space follows around anything else. The important part is that it's going around. When Earth completes one orbit around the sun, we call that one year. The length of one orbit for any planet is the length of its year.

oxygen: An important gas in the Earth's atmosphere that all animals, including humans, need in order to breathe. Scientists are looking at other planets to see if they have oxygen, because it would make it easier for humans to visit.

Learn more about the solar system by visiting these websites:

www.nasa.gov
Click on “Nasa Kid’s Club”.

www.chabotspace.org
The Chabot Space and Science center is a great place to visit if you live in Northern California. They also have activities and educational tools on their website if you live farther away.

www.space.com
Learn about all the latest space discoveries, see pictures of stars, planets, and all the other things that fill up our night sky.

www.darksky.org
Learn how your family can help everyone see more stars where you live.

Did you know?

On page 13, Saturn is a tiny star at the bottom of the constellation Leo. All the planets move around in the sky as they orbit the sun, and this is where Saturn was in the sky when this book was written in April 2008. The next time Saturn will be at that same place in the sky will be October 2037.

While we've sent many robots far out into space, **the farthest away from Earth that any human has gone is our moon.** The farthest human-made object is Voyager 1. We sent it out to explore space in 1977, and since then it's reached the very end of our solar system, and is still going.

On Titan, the moon on page 14, the atmosphere is so thick that you would be able to fly just by flapping your wings. Of course, you would have to build wings first.

On page 11, you can see Jupiter's Great Red Spot. The spot is a giant storm in the atmosphere of Jupiter. Three planets the size of Earth could fit inside of it. And that's just the spot - now you can imagine how big the whole planet is!

Even though we haven't found life in outer space yet, there are people study what it might be like. They're called **exobiologists and astrobiologists.**

The giant geyser on Enceladus, on page 16, spews outs millions of gallons of water and dust straight up into space. Most of it stays in orbit around Saturn, which means Enceladus is actually making one of Saturn's rings!

The Constellations

A constellation is a group of stars that makes a shape in the sky. Go back through the book and see if you can find these ones in the pictures:

Now that you know them, look outside next time the stars are out and see if you can find them in your own sky!

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