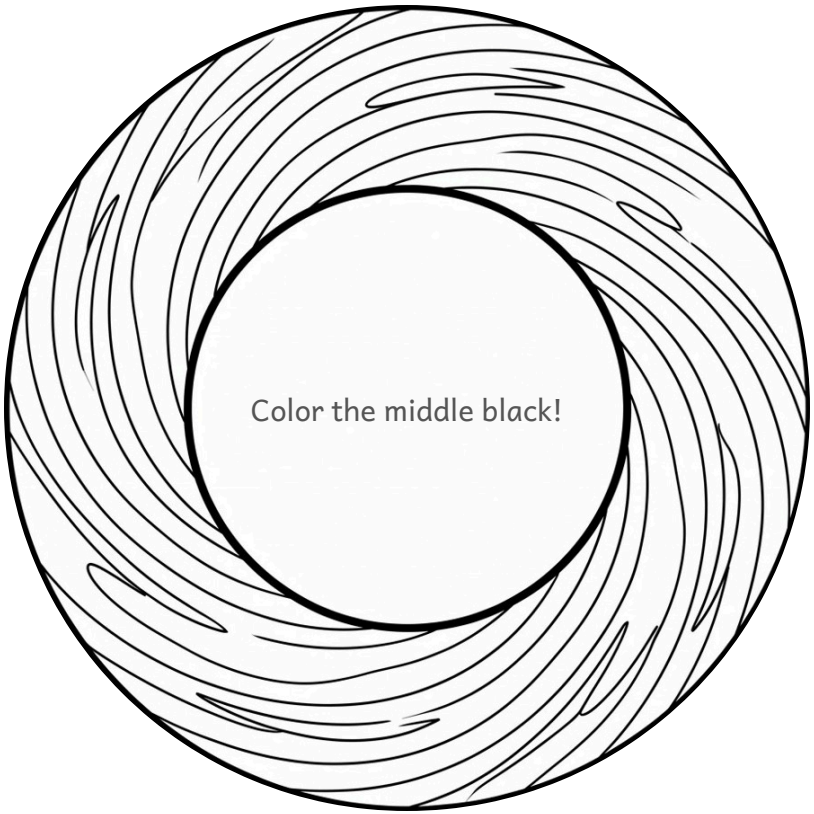
A Printable Scholar Space Book

How Big Is a Black Hole?

A zoom-out book of planets, stars and black holes



This book belongs to

_____

Earth and the Moon





The Moon
3,470 km wide

Earth
12,700 km wide

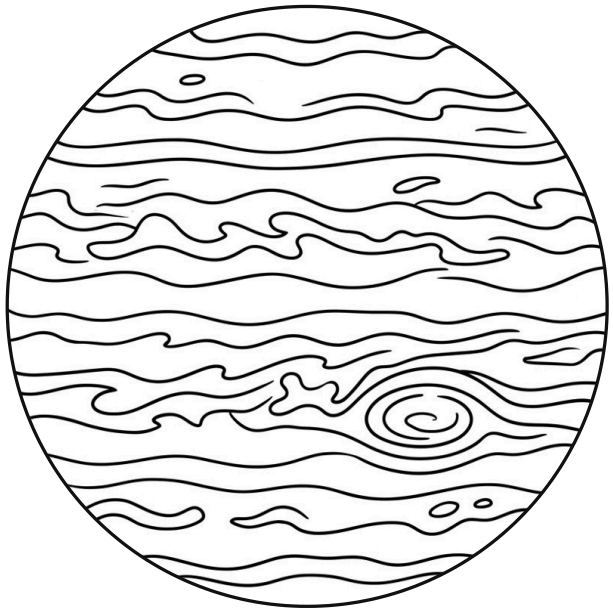
3.7× Earth is this many times as wide as the Moon.

Let's start close to home. Earth is almost 4 times as wide as the Moon. About 50 Moons could fit inside Earth.

Jupiter

Earth
12,700 km wide



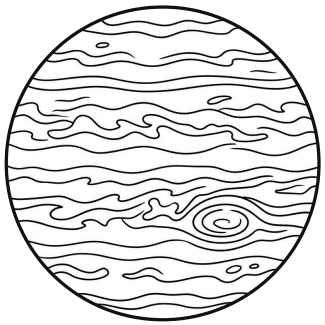


Jupiter
140,000 km wide

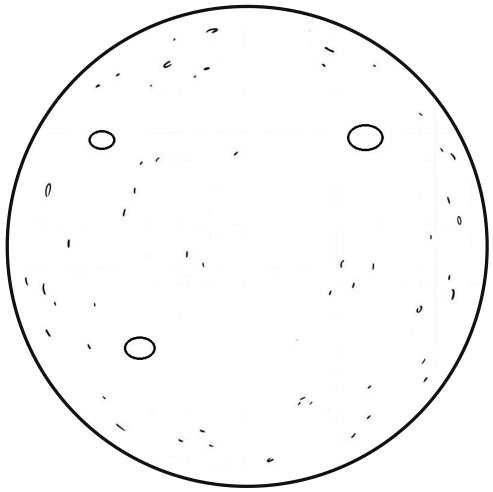
11× Jupiter is this many times as wide as Earth.

Jupiter is the biggest planet in our solar system. It is 11 times as wide as Earth. More than 1,300 Earths could fit inside it.

A Red Dwarf Star



Jupiter
140,000 km wide



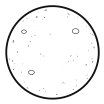
Proxima Centauri
215,000 km wide

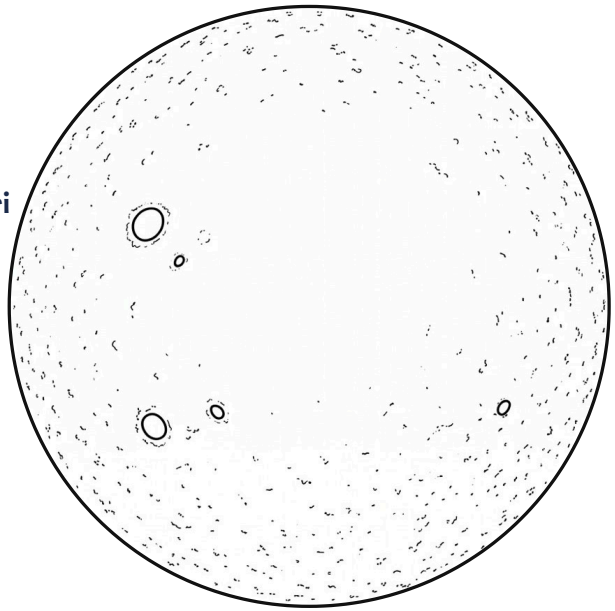
1.5× Proxima Centauri is this many times as wide as Jupiter.

Red dwarfs are the smallest stars, and there are more of them than any other kind. Proxima Centauri is the closest star to our Sun. It is only about 1.5 times as wide as Jupiter! Red dwarfs burn slowly. They can shine for trillions of years.

The Sun

Proxima Centauri
215,000 km wide



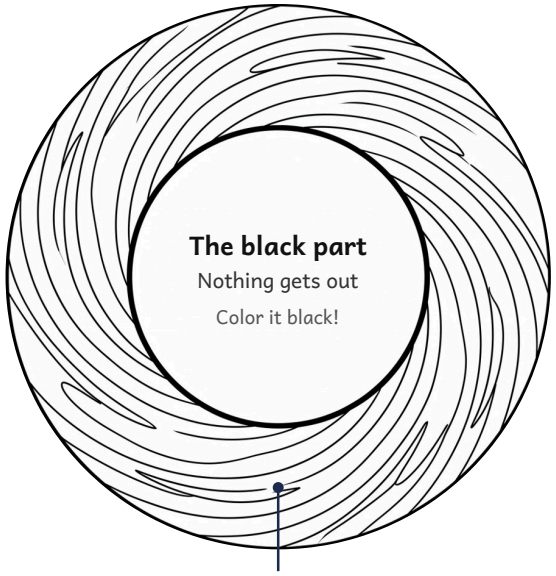


The Sun
1.4 million km wide

6.5× The Sun is this many times as wide as Proxima Centauri.

Our Sun is a much bigger star. It is about 6.5 times as wide as Proxima Centauri and 109 times as wide as Earth. More than a million Earths could fit inside the Sun.

What Is a Black Hole?

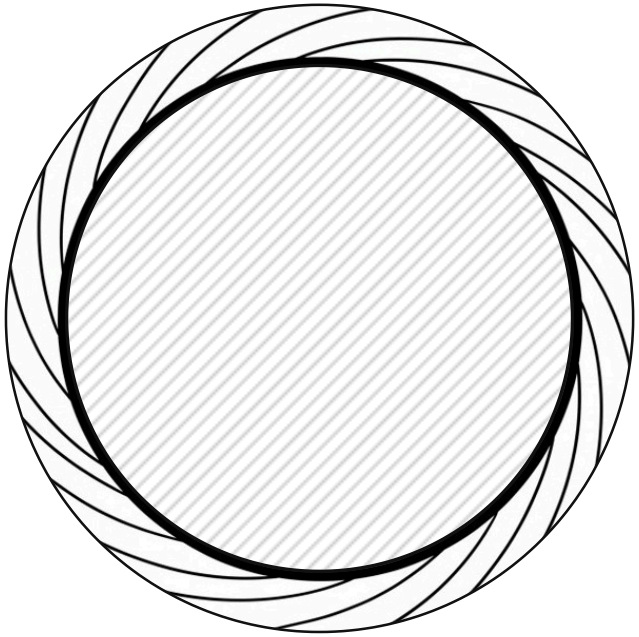


A black hole is a place where a huge amount of stuff is squeezed very close together. Its pull, called gravity, is so strong that nothing that gets too close can get out. Not even light! That is why it looks black.

How much stuff is in something is called its mass. The more mass a black hole has, the wider it is.

Sagittarius A*

The Sun
1.4 million km wide



Sagittarius A*
25 million km wide

18× Sagittarius A* is this many times as wide as the Sun.

Say it "A-star." This is the giant black hole in the middle of our galaxy, the Milky Way. It has as much mass as about 4 million Suns. The black part is about 18 times as wide as the Sun. In 2022, scientists showed the first picture of the glowing gas around it.

Betelgeuse

Sagittarius A*
25 million km wide



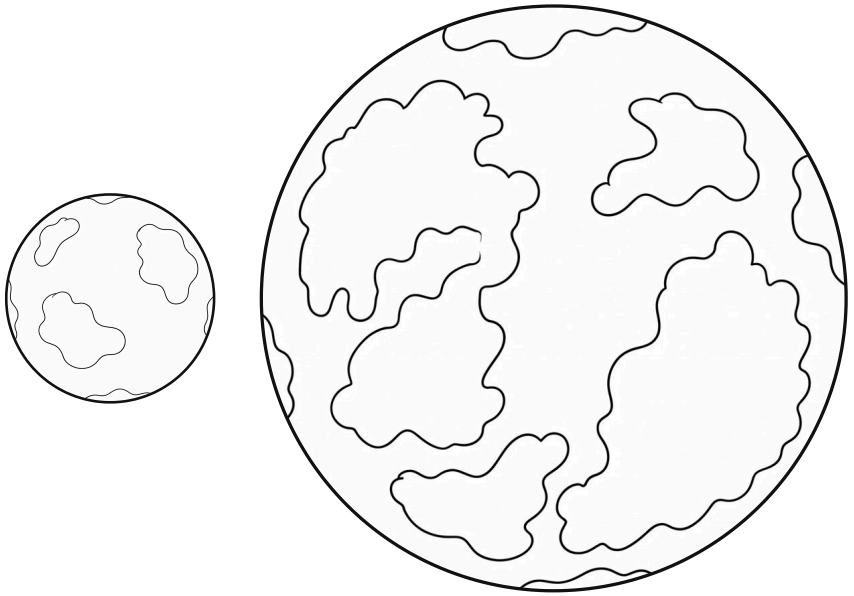
Betelgeuse
1.1 billion km wide

Too big to fit on the page!

42× Betelgeuse is this many times as wide as Sagittarius A*.

Say it "BEETLE-juice." Betelgeuse is a red supergiant star. It is so big that it will not fit on this page! It is about 42 times as wide as Sagittarius A*. Yes, a giant star can be wider than a giant black hole. One day Betelgeuse will blow up in a huge explosion called a supernova.

Stephenson 2-18



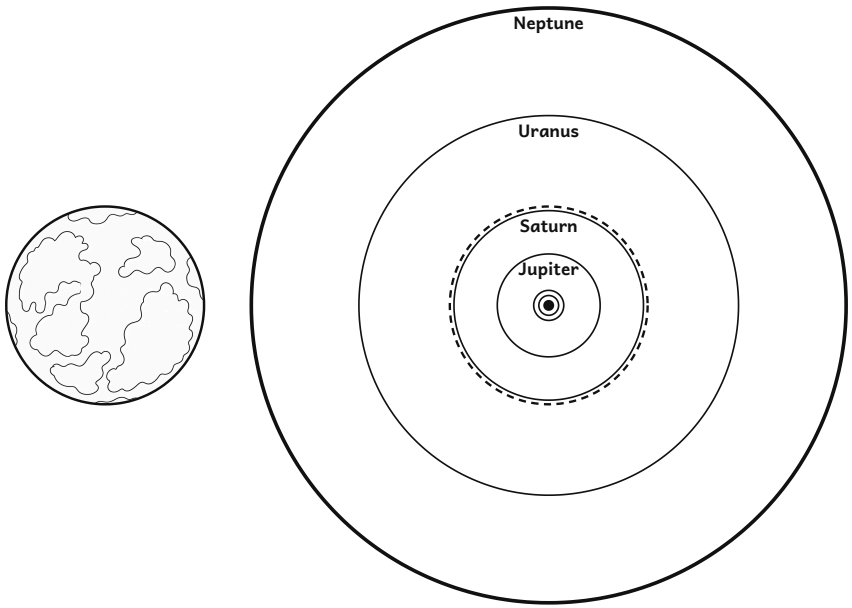
Betelgeuse
1.1 billion km wide

Stephenson 2-18
3 billion km wide

2.8× Stephenson 2-18 is this many times as wide as Betelgeuse.

This may be the biggest star ever found. It is almost 3 times as wide as Betelgeuse and about 2,000 times as wide as the Sun. If it sat where the Sun is, it would reach about as far as Saturn. It is very far away, so scientists are still working out its exact size.

The Solar System



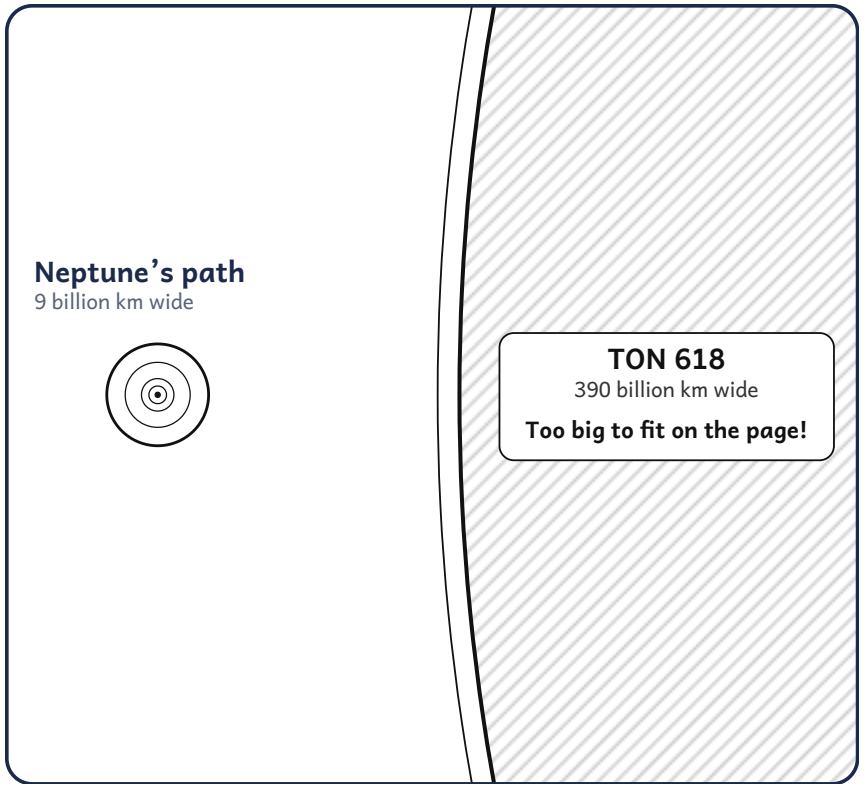
Stephenson 2-18
3 billion km wide

Neptune's path
9 billion km wide

3× Neptune's path is this many times as wide as Stephenson 2-18.

These rings are the paths the planets take around the Sun. Neptune is the farthest planet. Its path is 3 times as wide as Stephenson 2-18. That is about 9 billion kilometers across. The dotted circle shows how big Stephenson 2-18 would be if it sat where the Sun is. Light from the Sun takes more than 4 hours to get to Neptune.

TON 618



43× TON 618 is this many times as wide as Neptune's path.

TON 618 is one of the biggest black holes ever found. Its mass may be as much as 66 billion Suns. That would make it about 43 times as wide as Neptune's path. Our whole solar system is the little set of rings on the left! Light needs about two weeks to cross this black hole.

So, How Big Is a Black Hole?

It depends on its mass. More mass makes a wider black hole.



A small black hole
The mass of 10 Suns
About 60 km wide: as wide as a big city



Sagittarius A*
The mass of 4 million Suns
25 million km wide: as wide as 18 Suns in a row



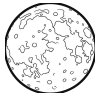
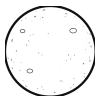
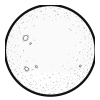
TON 618
The mass of 66 billion Suns
390 billion km wide: as wide as 43 solar systems in a row

So a black hole can be smaller than a star, or bigger than our whole solar system.

And space keeps going! Our galaxy, the Milky Way, is more than 2 million times as wide as TON 618.

The Line-Up

Smallest to biggest. The number is how wide each one is.

	**The Moon** Earth's moon	**3,470 km** 2,160 miles
	**Earth** Our planet	**12,700 km** 7,920 miles
	**Jupiter** The biggest planet	**140,000 km** 86,900 miles
	**Proxima Centauri** A red dwarf star	**215,000 km** 133,000 miles
	**The Sun** Our star	**1.4 million km** 865,000 miles
	**Sagittarius A*** The black hole in the middle of our galaxy	**25 million km** 16 million miles
	**Betelgeuse** A red supergiant star	**1.1 billion km** 660 million miles
	**Stephenson 2-18** Maybe the biggest star known	**3 billion km** 1.9 billion miles
	**Neptune's path** The path of the farthest planet	**9 billion km** 5.6 billion miles
	**TON 618** One of the biggest black holes known	**390 billion km** 240 billion miles

The little pictures here are all drawn the same size. Black hole sizes are the width of the black part, where nothing can get out.

Which Is Bigger?

Circle the bigger one in each pair. Look back in the book if you need to.

1	 **Jupiter**	or	 **Proxima Centauri**
2	 **Sagittarius A***	or	 **The Sun**
3	 **Betelgeuse**	or	 **Sagittarius A***
4	 **Stephenson 2-18**	or	 **Neptune's path**
5	 **Earth**	or	 **The Moon**
6	 **TON 618**	or	 **Stephenson 2-18**

Answers: 1. Proxima Centauri • 2. Sagittarius A* • 3. Betelgeuse • 4. Neptune's path • 5. Earth • 6. TON 618

Sizes of faraway stars and black holes are scientists' best measurements so far. They may change as we learn more.