SCIENCE MUSEUM

Welcome to the Museum

ADMIT ALL

Planetarium

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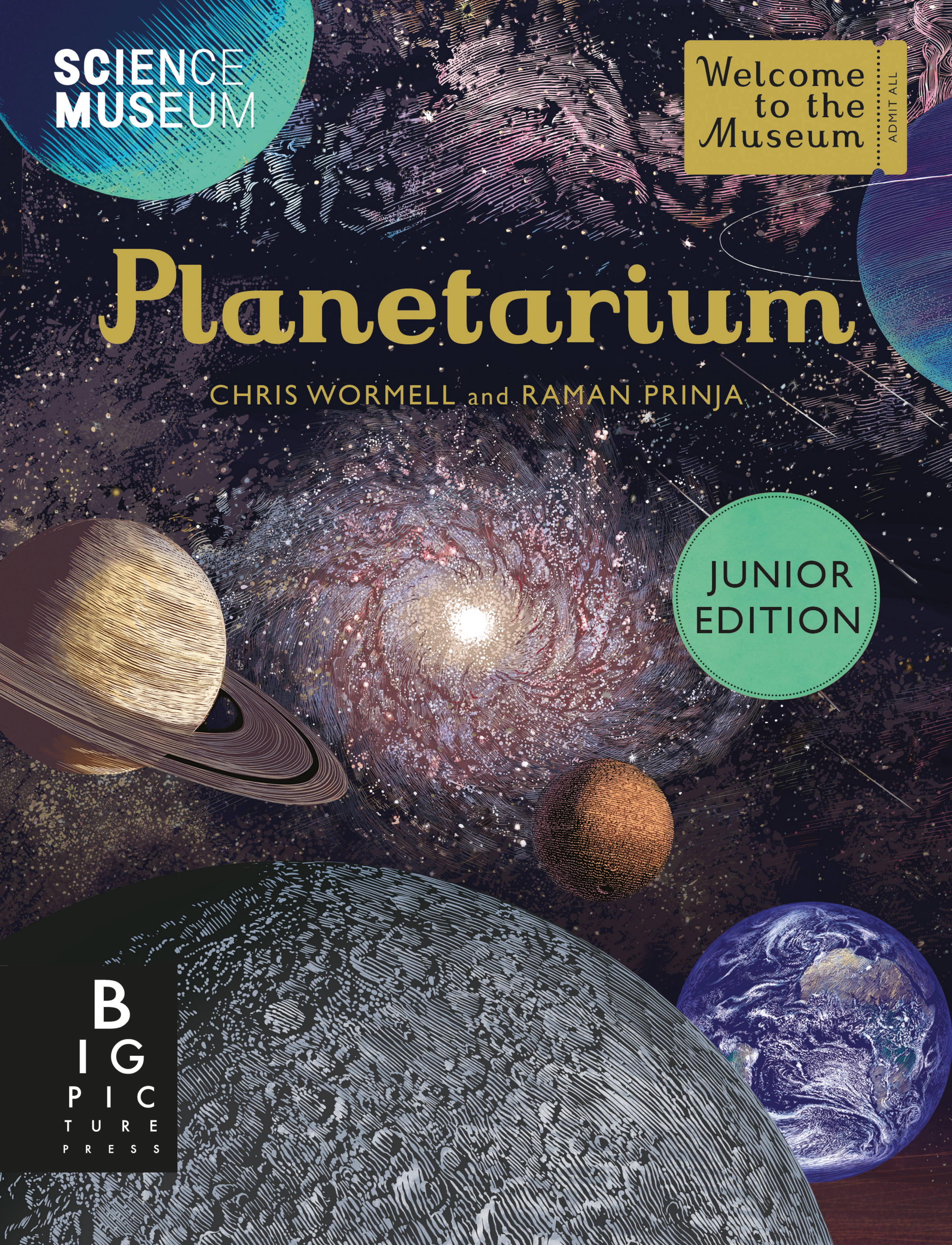
JUNIOR EDITION

BIG PICTURE PRESS



Our Place in the Universe

The Universe contains absolutely everything, from tiny atoms to giant galaxies. It is so big that it can be hard for us to imagine its size. But one way of doing this is imagining Earth's 'cosmic address'. So, instead of writing down a house number, street, town and country, we replace each line with larger and larger structures in space.

Our cosmic address starts with our planet, Earth. Earth is one of eight planets in the Solar System, so that is the next line. The Sun is at the centre of the Solar System and is one of 200 billion stars in the Milky Way Galaxy; the Milky Way is one of about 50 galaxies in a cluster called the Local Group; this is one of many galaxy clusters in the Virgo Supercluster; and finally the Virgo Supercluster is part of a region in space called Laniakea. This means that our cosmic address is: Earth, Solar System, Milky Way Galaxy, Local Group, Virgo Supercluster, Laniakea, Universe.

While this helps us imagine the Universe, scientists still need ways of measuring its sheer size. Miles and kilometres are no help at this scale. Instead, astronomers use light years – the distance light travels in one year. Since light has a speed of 300,000km per second, the distance it travels in a year is 9.5 trillion km. The distance between our Sun and the planet Neptune is 0.0005 light years. The Milky Way is 100,000 light years across. But largest of all, the Universe is 93 billion light years wide.

Key to plate

1: Our place in the Universe
a) Earth
b) Solar System
c) Milky Way Galaxy
d) Local Group
e) Virgo Supercluster
f) Laniakea
g) Universe

Telescopes

Objects in space, such as stars and galaxies, are very far away, and only a tiny amount of their light reaches Earth. This is because light spreads out as it moves further from its starting point. To look at space in any detail, we rely on telescopes – special instruments which make distant objects appear much larger.

Telescopes act like 'buckets' for collecting faint light. Just as a bigger bucket catches more rainwater, a bigger telescope gathers more light. The pupils of our eyes are barely 5mm across, but modern telescopes can be more than 10m wide – a telescope that size can see objects four million times fainter than those we can see just with our eyes.

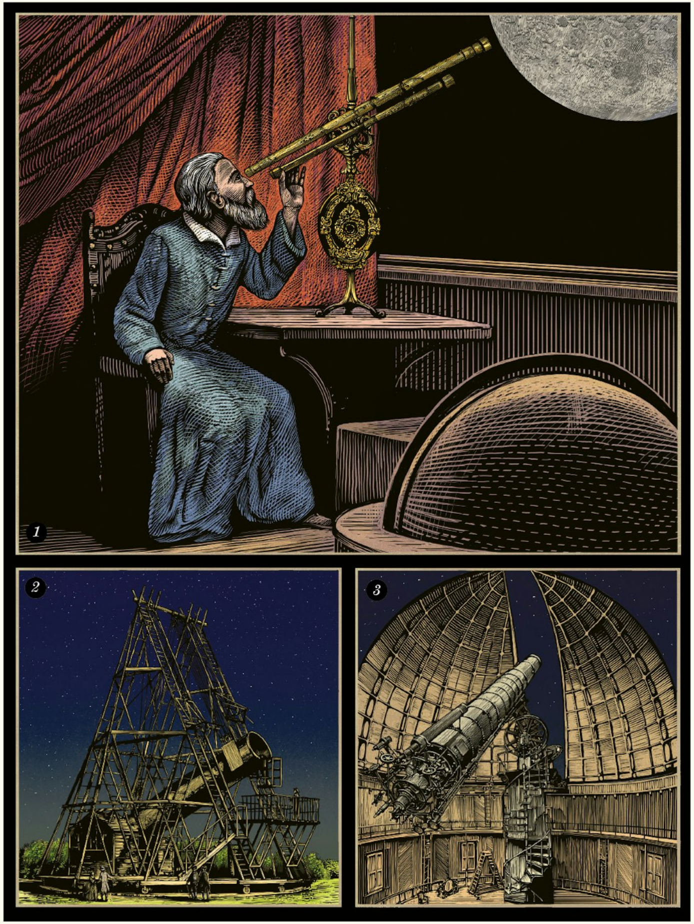
Telescopes work by collecting light using a lens or mirror. The light is focused into a small sharp image and the image is magnified (made bigger). The two main types of telescope are refractors and reflectors. Refracting telescopes use lenses to bend, or refract, light. The light enters through the front lens and travels through the telescope to the eyepiece, where it is magnified. Reflecting telescopes use mirrors to reflect light. Light enters the telescope, bounces off a curved primary (first) mirror, then is reflected off a smaller secondary mirror, which magnifies the image.

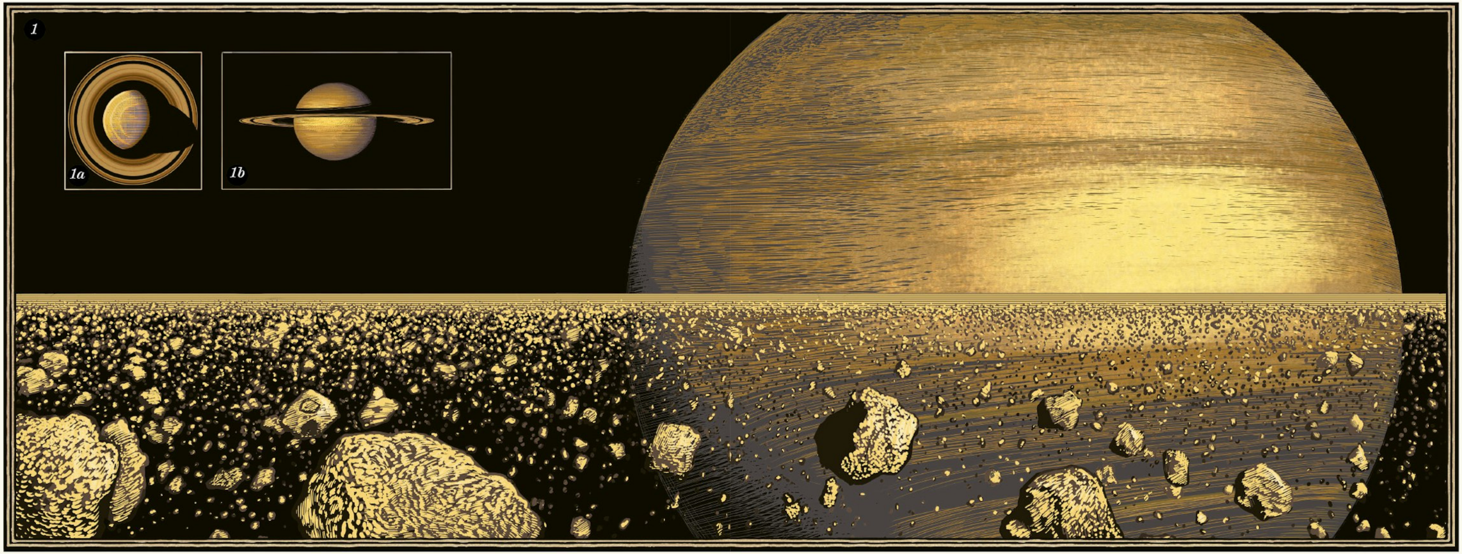
Key to plate

1: **Galileo's x20 telescope**
Lens width: 37mm
This imagined view shows famous astronomer Galileo Galilei using a refracting telescope in 1609. It was one of the first telescopes ever made.

2: **Herschel's 40-foot reflecting telescope**
Mirror width: 120cm
William Herschel started constructing the telescope in 1785. At the time, it was the largest telescope in the world.

3: **James Lick telescope**
Lens width: 91cm
At the time of its construction in 1888 this was the largest refracting telescope in the world – it is the third largest today.





Saturn

Saturn is the sixth planet from the Sun. It is a huge gas giant surrounded by beautiful, bright rings. Although the rings look solid from a distance, up close they are made of billions of ice particles, along with fine dust and house-sized boulders. Scientists think the rings formed when a moon drifted too close to Saturn and was broken up by the planet's gravity.

Like the other gas giants, Saturn is a huge ball of gases and liquids. It is mostly made up of hydrogen and helium, which are some of the lightest gases in the Universe. In fact, Saturn would float in water if you could find a bathtub big enough to hold it!

Saturn is surrounded by more than 60 moons. Its moon Titan is the second largest in the Solar System. Scientists are very interested in this moon because it looks a lot like Earth did at the time when life first appeared on our planet – it might even be home to extraterrestrial life.

Key to plate

1: Saturn
Diameter: 120,536km
Orbital period (year): 29.4 Earth years
Rotation period (day): 10.7 hours
Known moons: 62

The Romans named Saturn after the father of Jupiter in mythology.
a) The planet viewed top-down
b) The planet viewed edge-on

Star Life Cycles

Stars shine by converting hydrogen atoms into helium atoms inside their core. But at some point, every star will run out of helium 'fuel'. What happens next depends on how big the star is.

The smallest stars (or lightweight stars) range from lighter than our Sun to eight times its mass (the amount of matter it has). They spend several years making energy before running out of fuel. Then they swell out into red giants, and turn into white dwarf stars.

Middleweight stars start off 8 to 20 times the mass of the Sun. They burn much faster than Sunlike stars, using up their fuel supply in less than a billion years. At this point they swell into supergiants, then die in a huge explosion called a supernova. The only thing left behind will be a very dense, city-sized core called a neutron star.

The most massive (heavyweight) stars are more than 20 times the mass of the Sun. In just a few million years they use up all their fuel. They quickly grow into enormous blue supergiants, then just as quickly collapse in the lead up to a supernova explosion. The life cycle of heavyweight stars ends with the creation of a black hole (see p.62).

Key to plate

1: **Interstellar nebula**
This is a cloud of dust and gas where stars are born.

2: **Protostar**
Gas spins round the star as it forms, making a wide disc.

3: **Lightweight star life cycle**
a) The star shines for a few billion years.
b) The star becomes a red giant when it runs out of hydrogen. Its core collapses and its outer layers swell.
c) Its outer layers are shed – this is called a planetary nebula.
d) All that remains is the shrunken core, called a white dwarf.

4: **Middleweight star life cycle**
a) The star burns its fuel very quickly.
b) When the star runs out of fuel, it expands into a red supergiant.
c) The star explodes – this is called a supernova.
d) All that remains is a dense core called a neutron star.

5: **Heavyweight star life cycle**
a) The star shines.
b) When the star runs out of fuel, it expands into a huge blue supergiant.
c) The star explodes as a supernova.
d) If the core is more than three times the mass of the Sun, it becomes a black hole.