Opening extract from

See Inside the Universe

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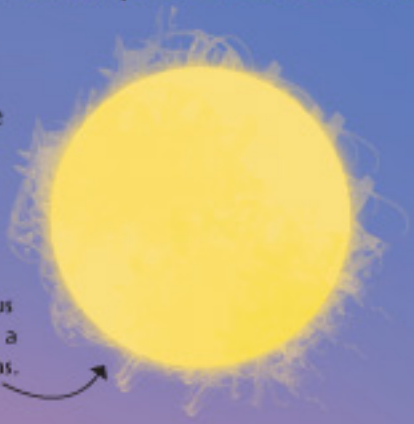
Where is the Universe?

If you look out into space, in any direction, that's the Universe. Most of the Universe is empty – but in amongst that emptiness there are countless billions of stars, planets and all sorts of cosmic objects.

Even without a telescope, it's easy to see shining points of light, called STARS.

One star, the Sun, is almost close enough for us to see it for what it really is: a gigantic ball of exploding gas.



Large balls of rock, ice and gas are called PLANETS.

Planets move around, or orbit, stars.

Smaller balls of rock and ice that orbit planets are called MOONS.

Balls of ice with glowing tails are called COMETS.

Comets orbit around the Sun, but are usually much, much further away than other planets.

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Looking through really powerful telescopes, astronomers have identified all sorts of wonderful things in space. (But in real life, they're not this close together.)

Stars come in many varieties...

This vast swirling cloud of space dust is called a NEBULA. Over millions of years, it will merge together in sections to form a new star system.

This is a SUPERNOVA – an exploding star.

The brightest star visible from Earth is called Sirius.

Stars look as if they're scattered here, there and everywhere. In fact, they huddle together to form brain-bendingly enormous collections of stars known as GALAXIES.

What's this?

Many galaxies revolve around a central point.

Looking at distant galaxies is a little like going back in time...

Cartwheel galaxy

Most galaxies form a shape.

Elliptical galaxy

Astronomers believe that a large amount of apparently empty space in fact contains a substance known as DARK MATTER.

...and the end

Most scientists believe that, countless billions of years into the future, the Universe will come to an end. But no one knows exactly how or when it will happen.

1 The most likely scenario is known as the HEAT DEATH OF THE UNIVERSE.

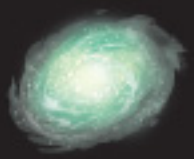
Trillions of years from now, all the stars will gradually fade away into the darkness.

Without stars, there will be no more light, no more heat, and – most likely – no more living things.

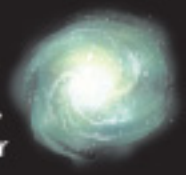
Nothing will happen, so it will be impossible to tell that time is passing.

The Universe will still exist, but it will be cold, dead and boring.

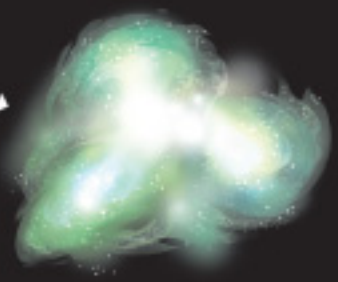
2 Another possible ending is that the Universe will gradually start to COLLAPSE IN ON ITSELF.



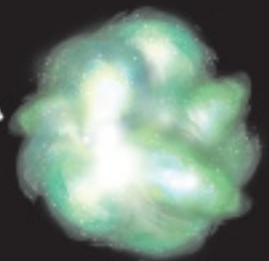
Galaxies, and the stars within them, will all draw closer together.



Whole galaxies will merge.



Far, far into the future, the Universe will be compressed into a tiny hole – an event described as the BIG CRUNCH.



It's entirely possible this will trigger a new BIG BANG, kicking off a new Universe...

What happened during the Big Bang?

1 Time began:

The only thing scientists know about the very first instant is that it's literally impossible to observe, test or study it.

2 Fractions of a second later:

The Universe inflated, almost instantaneously, to golf-ball size.

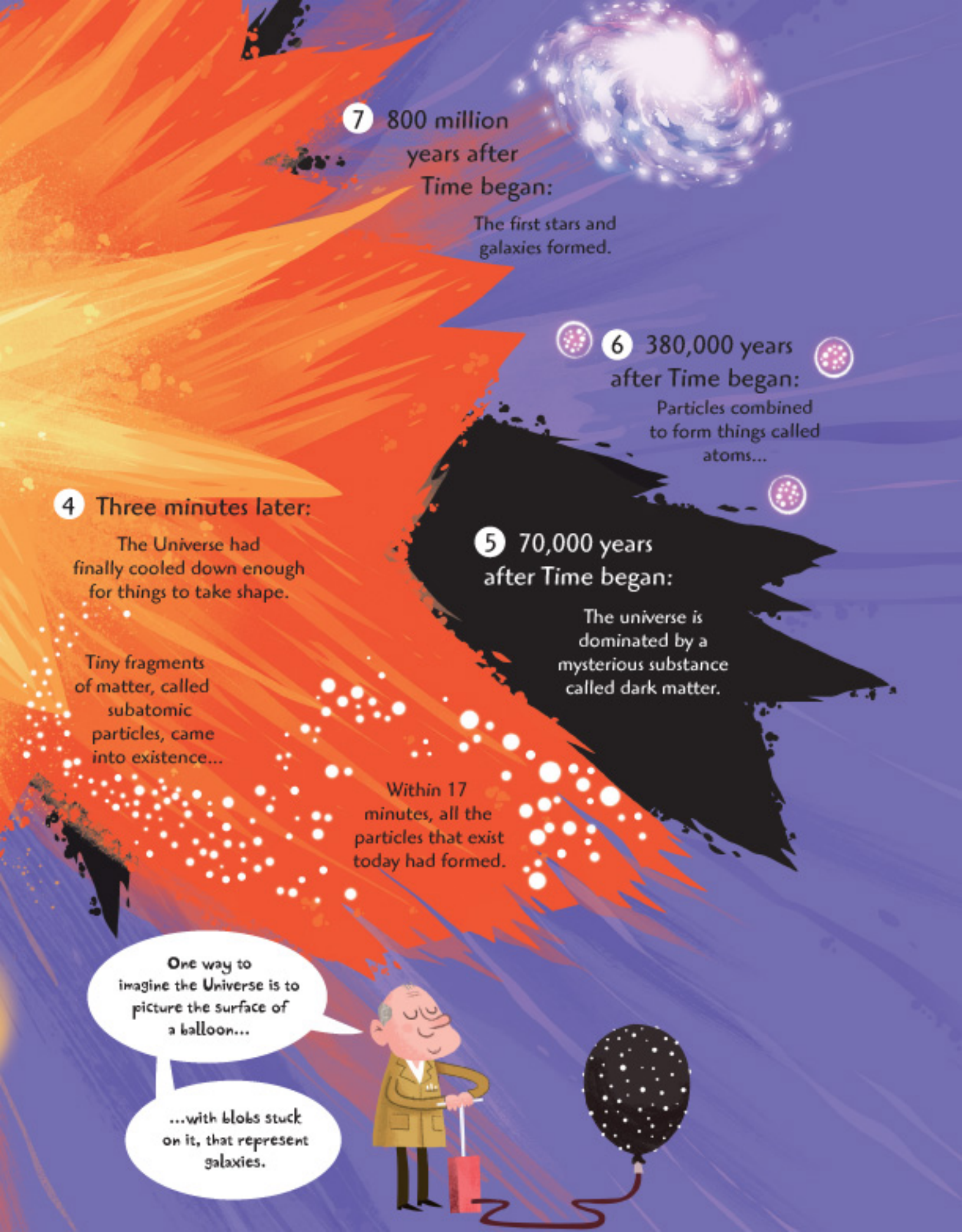
It's only at this point that scientists can begin to study what happened.

3 Three seconds later:

The first types of stuff started to appear...

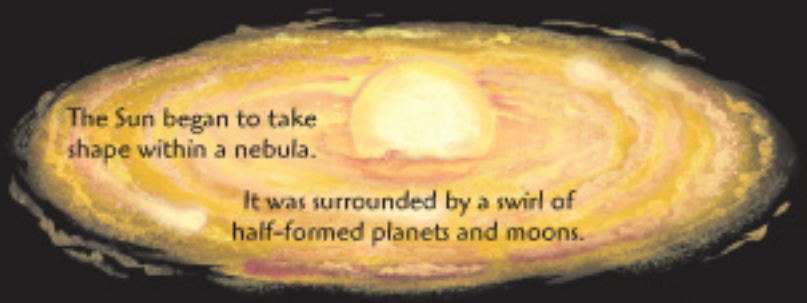
...but it was too hot and dense for anything to take shape. The Universe was filled with a shapeless mess known as plasma.

From the start, and lasting for a million years, the Universe was unimaginably hot. This infernal period is known as the PRIMORDIAL ERA.


7 800 million years after Time began:
The first stars and galaxies formed.
6 380,000 years after Time began:
Particles combined to form things called atoms...
5 70,000 years after Time began:
The universe is dominated by a mysterious substance called dark matter.
4 Three minutes later:
The Universe had finally cooled down enough for things to take shape.
Tiny fragments of matter, called subatomic particles, came into existence...
Within 17 minutes, all the particles that exist today had formed.
One way to imagine the Universe is to picture the surface of a balloon...
...with blobs stuck on it, that represent galaxies.

The life and death of planet Earth

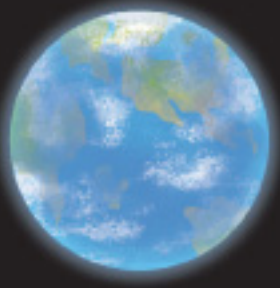
1 4.6 billion years ago
(around 9 billion years after time began):



The Sun began to take shape within a nebula.

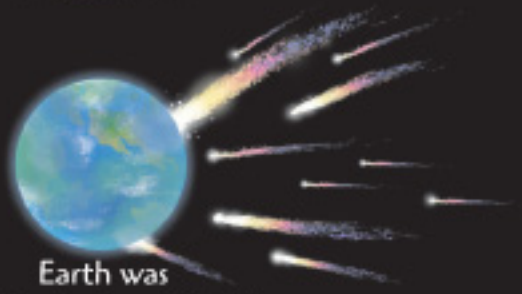
It was surrounded by a swirl of half-formed planets and moons.

2 4.5 billion years ago:



The Moon came into being.

3 4 billion years ago:



Earth was bombarded by asteroids and comets.

4 2,300 million years ago:

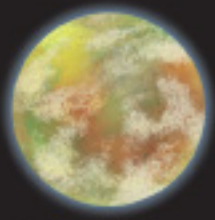
'Snowball Earth'

Earth was entirely covered in ice.

5 Now:

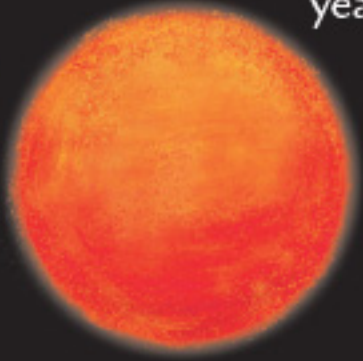
Earth as it looks today.

6 1 billion years from now:



The Sun will burn so brightly that the Earth's oceans will start to evaporate.

7 3 billion years from now:



The Sun will start to expand, becoming a red giant.

Mercury

Venus

Earth

Mars