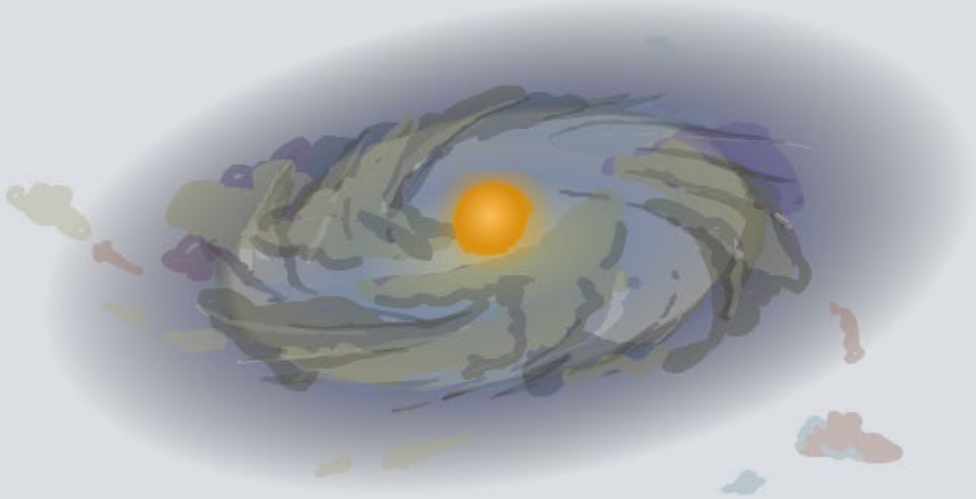
The Life Cycle of Stars



The Universe

The **Universe** consists of all the matter and the energy that exists.

It is believed to be around 14 billion years old, and at least 93 billion light years across.

The Universe is believed to have originated in the Big Bang. It is changing all the time, both expanding in size, and changing in composition.

It contains billions of galaxies, each containing billions of stars. Even the darkest region of space reveals countless galaxies.

Our galaxy – the Milky Way

Our solar system lies in the Orion arm of the spiral galaxy called the Milky Way.

In the night sky, all of the bright stars and most of the dim ones lie close to us in the same arm of the spiral.

There are billions of stars in the Milky Way, with potentially billions of planets in orbit around them.

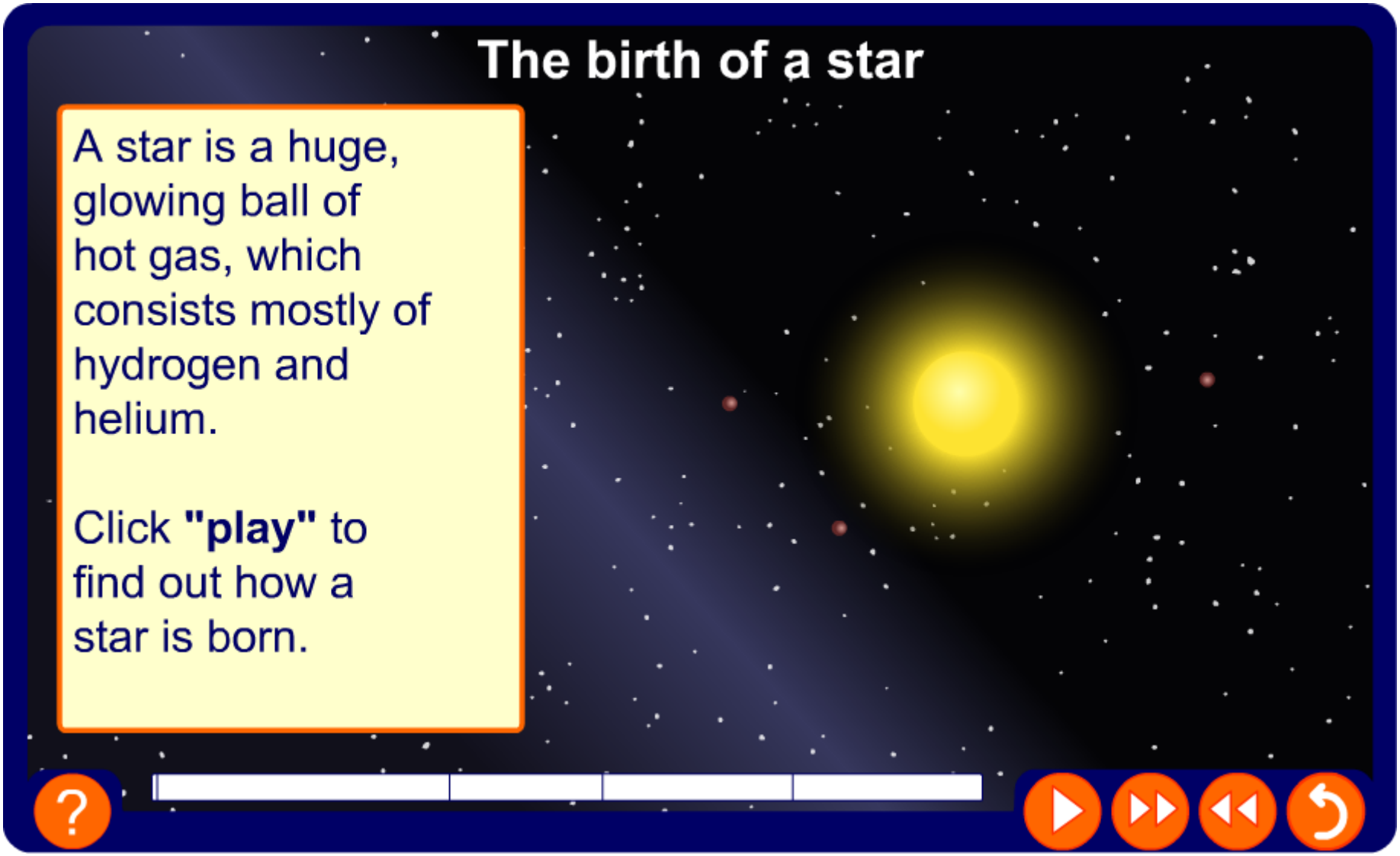
A computer generated image of the Milky Way.

How is a star formed?

The birth of a star

A star is a huge, glowing ball of hot gas, which consists mostly of hydrogen and helium.

Click **"play"** to find out how a star is born.



Protostar pressure

What happens to a protostar as it contracts?

During the early stages of a star's formation, gravity forces the particles closer together.

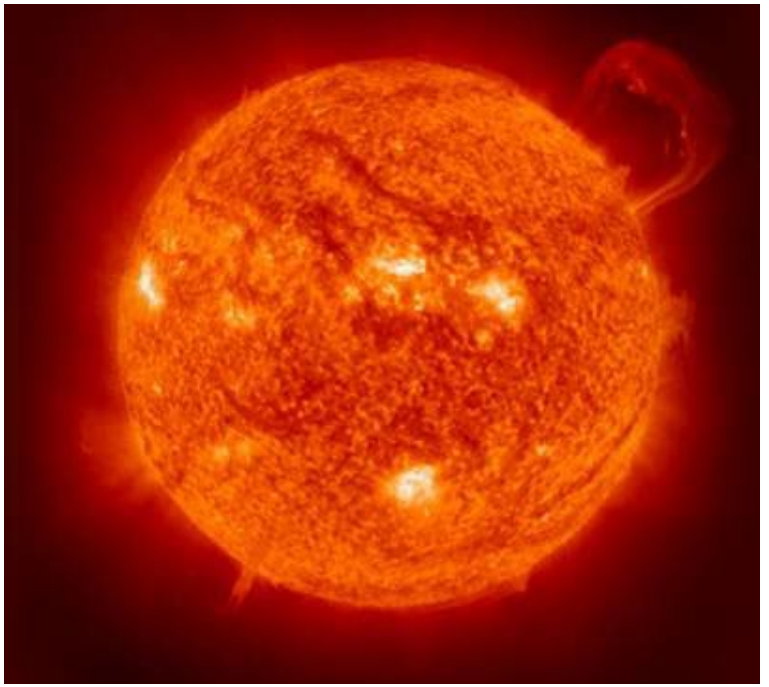
As the protostar contracts the pressure inside increases. This increases the star's temperature.

Press **"start"** to investigate.

start

Finding stability

When the temperature in the core of a protostar reaches roughly 14 million Kelvin, nuclear fusion begins and a stable star is born.



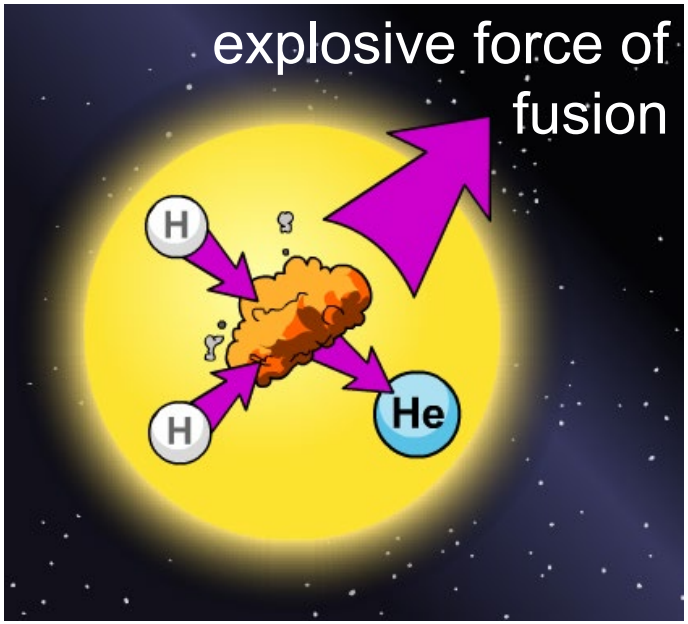
The star now enters its stable phase.

A star is stable when its size remains constant over time. All stars have a stable period in their lives, the length of which is determined by their mass.

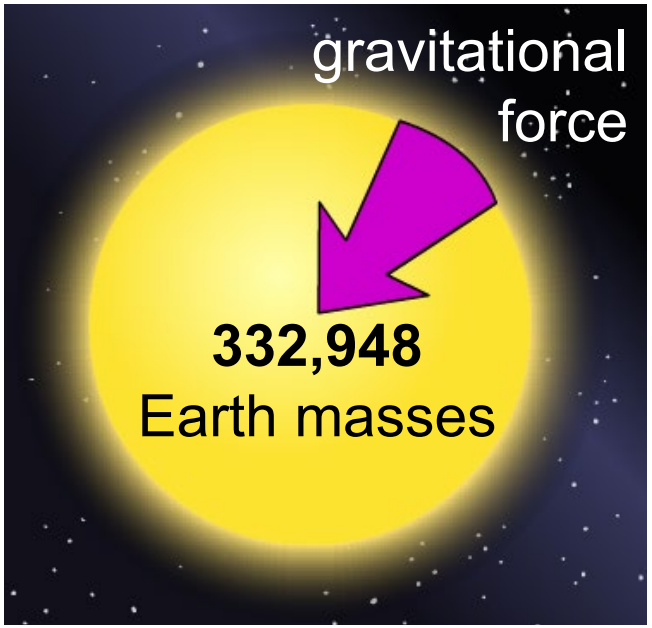
The Sun is halfway though its nine billion year stable phase.

What makes a star stable?

Inside a star, the energy released by fusion produces an outward acting force. This causes star expansion.



However, the star's huge mass means that gravity is acting in the opposite direction, forcing particles towards the core.



If these two forces are equal, then the star will not change its size. It is said to be **stable**.

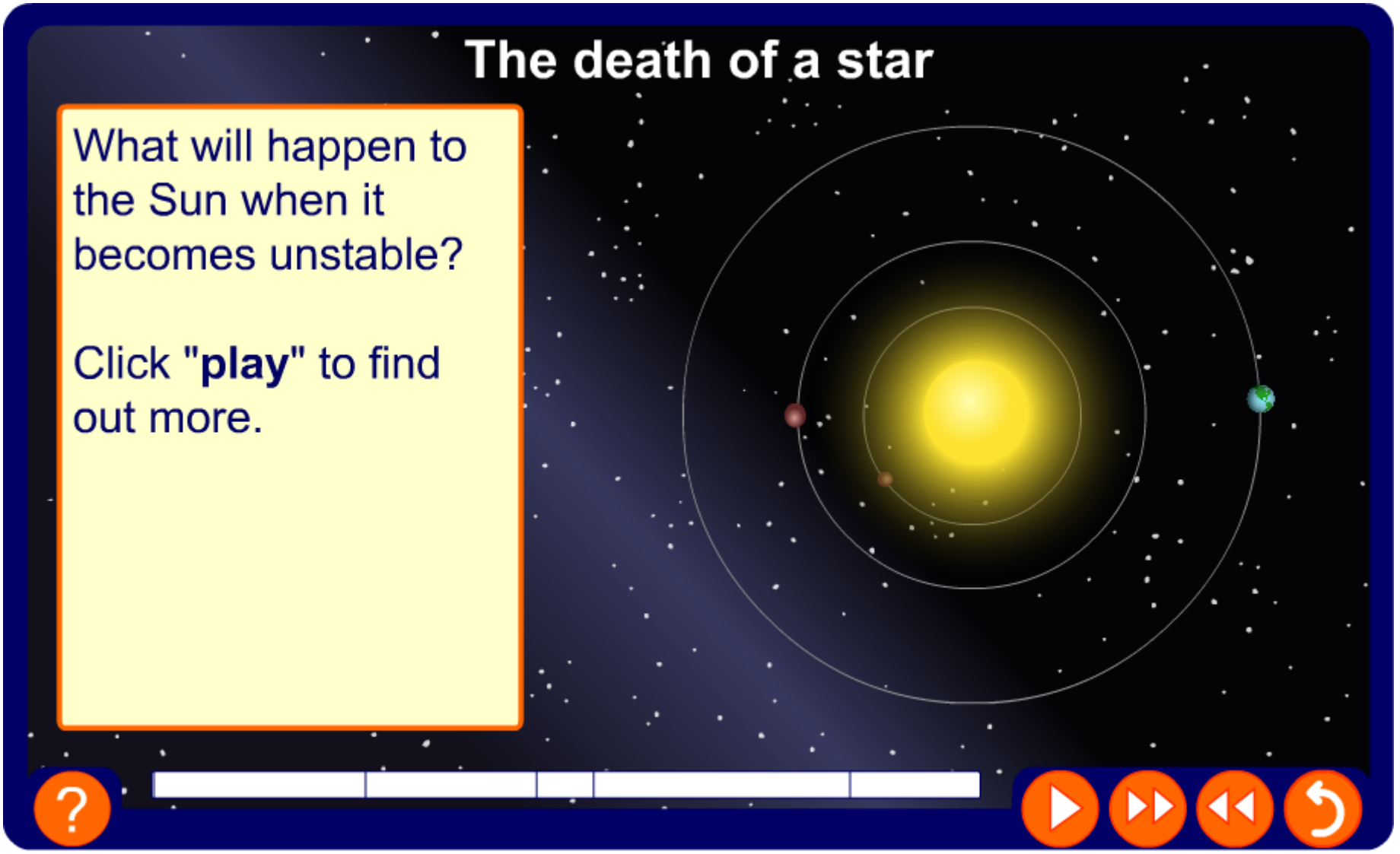
Stable star structure

Inside a stable star

A star is not a uniform ball of burning hydrogen. Its inner environment varies significantly as you move from the surface to the core.

Click on the star to reveal its inner layers, and learn about the environment in each.

The death of a star



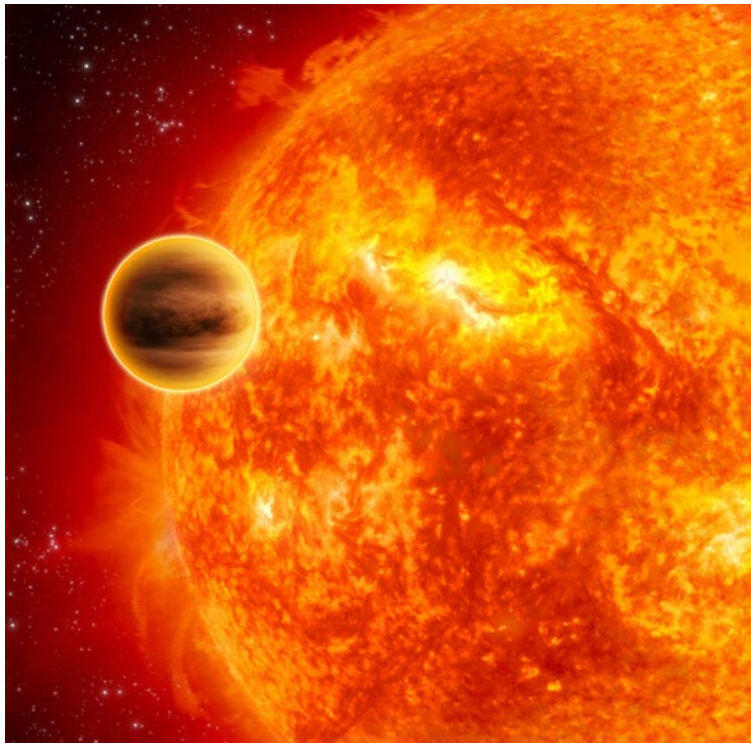
The end of stability

A star's stable phase ends when most of its hydrogen has been consumed by fusion.

The reduction in fusion causes the core to cool. This lowers the pressure causing the star to collapse upon itself under its own gravity.

As the outer layers contract, they heat up. This triggers the fusion of the remaining hydrogen. The increased energy output in the outer layers causes them to expand.

The star increases massively in size, becoming a red giant.



What happens in the core?

The core continues to contract. This causes it to reach new extremes of temperature (over 100 million Kelvin) and pressure.

This gives helium atoms enough energy to fuse.

Thus heavier atoms, such as carbon and oxygen, are produced.

In the largest stars elements as heavy as iron can be produced. However such large stars will suffer a different fate to the Sun.

Red supergiants

The death of a massive star

The Sun is a relatively small star. How would its fate differ if it were much larger?

Click "**play**" to find out more.