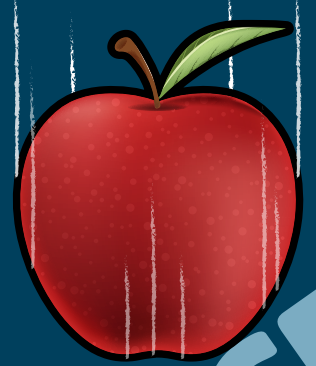


LITTLE
POSTER
OF

GRAVITY

Gravity is what pulls everything toward the Ground, including you. When you throw a ball into the air, gravity is what makes it fall back down again. Without gravity, there would be no life on Earth. In fact, there would be nothing on Earth at all. All the animals, cars, buildings, you and me, and even all the water would fly into space.

According to the famous story, which may or may not be true, Sir Isaac Newton was sitting under an apple tree one day in about 1665 when an apple fell and landed on his head.



This made Newton wonder why the apple fell down, instead of up or to the side. He realised that there must be a special kind of force that acts on all the objects on Earth and pulls them to the ground.

NEWTON'S GRAVITY

Gravity isn't just something that happens on Earth. Throughout the Universe it is the force that draws two objects together. Newton's theory of gravity showed us that gravity is a predictable force that acts on all matter in the Universe.

Every particle of matter is attracted to every other particle of matter – and that gravity's strength is affected by an object's mass and how far apart the objects are.

Gravity is also affected by how close an object is. The further away an object is, the less its gravitational pull is felt by another object. This is why a meteorite falls towards the Earth and not towards the Sun even though the Sun is much more massive.

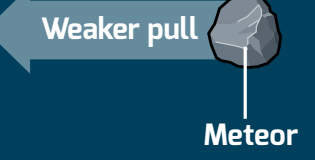
MORE MASS, MORE PULL



Earth



Meteorite falls towards Earth



Meteor

Newton's gravity was an excellent explanation of how gravity works but it didn't explain where gravity came from and what created the force that draws objects together.

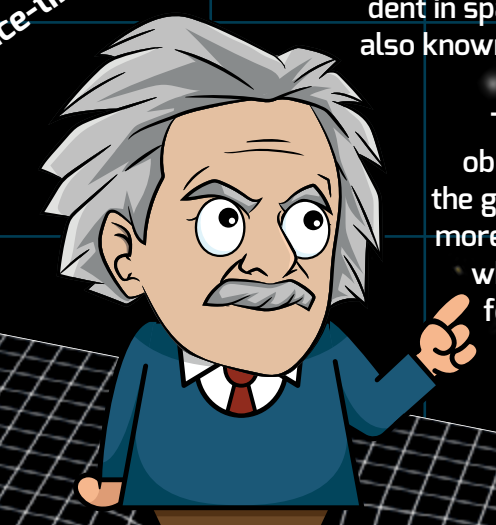
Einstein imagined that, instead of space being, well, empty space with the odd star and galaxy scattered through it, space was actually made up an invisible structure called space-time.

He figured out that if you were to place massive objects, such as a planet, moon or meteor, on this sheet, they would make a dent in space-time. This dent also known as a gravity well.

The more mass the object has, the bigger the gravity well and the more gravity it has. But what does this mean for why things fall?

EINSTEIN'S GRAVITY

Then a German-born physicist called Albert Einstein came up with a very different theory of how gravity works called his 'General Theory of Relativity'. He discovered that gravity was not a force at all. Instead, he realised that gravity is actually a side-effect of objects with mass making 'dents' in the fabric of the Universe itself – something known as space-time.



SPACE-TIME



ORBITS ACCORDING TO NEWTON: IT'S JUST FALLING WITH STYLE

If you fire a cannonball from a cannon you can see that as soon as it is fired, gravity takes effect and starts to pull the ball back towards the Earth, which is why it travels in an arc.



Newton came up with the idea that if you could fire a cannonball with enough speed, instead of falling back to Earth, it would fall around the Earth in a circular orbit. It is this effect that keeps satellites in orbit.



He also suggested that a cannonball fired with enough speed would escape Earth's gravitational pull and travel into space.



WHY DO THINGS FALL?

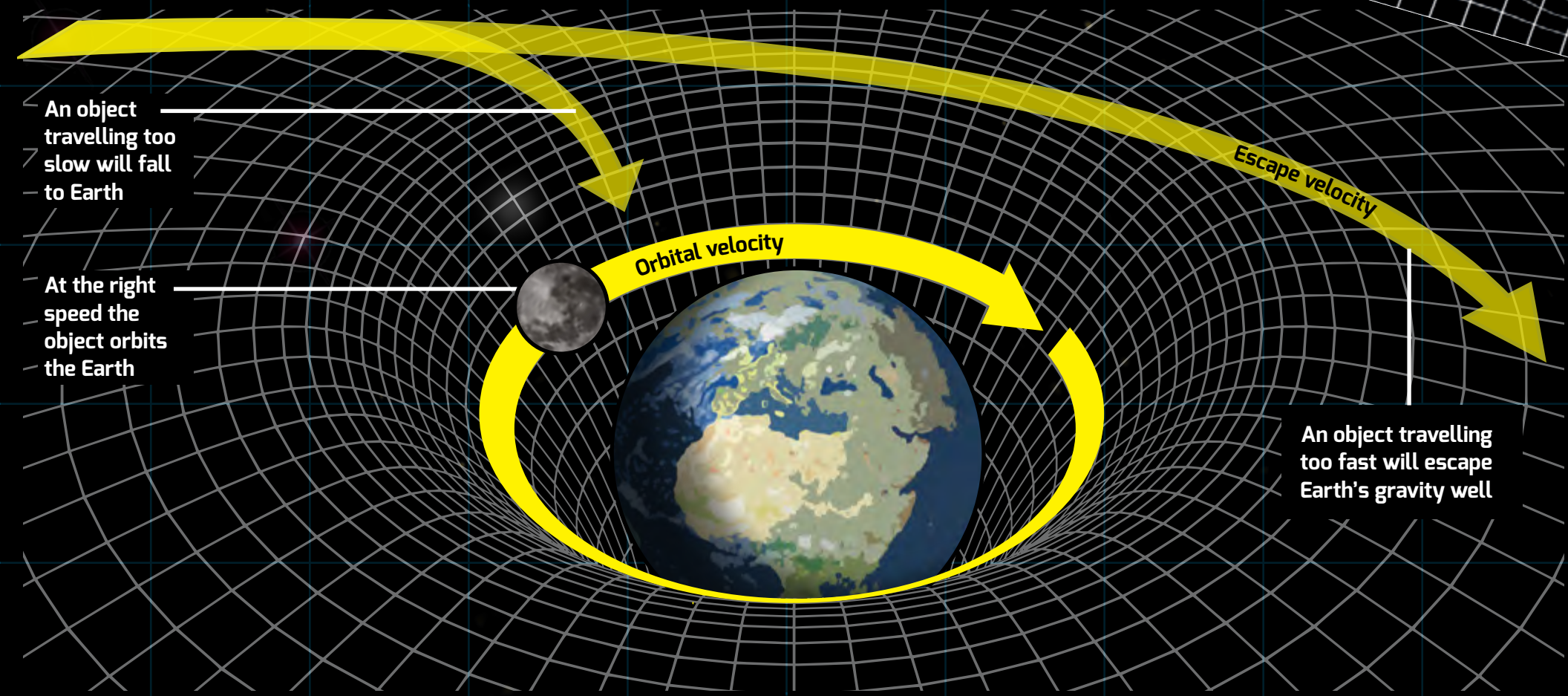
Einstein showed us that things don't fall because they are attracted to each other, or because they 'pull' on each other, but because one object is making a bigger dent in space-time than another object.

Small objects like meteors seem to be attracted to the Earth because a planet makes a much deeper dent in space-time. The meteor just falls into the dent a bit like a golf ball rolling into a hole.

SO, WHY DOESN'T THE MOON FALL?

Newton wasn't wrong when he imagined that an object will orbit a planet because it is falling around the planet at the right speed. The Moon orbits the Earth because, although it is falling into the Earth's gravity well, it is moving fast enough to sort of 'roll' around the edge of the well.

Imagine rolling a marble around the edge of a bowl – if you push it too fast, it'll fly out, but if you push it at the right speed, it'll roll around the edge as if orbiting. When it slows down, it'll fall to the bottom of the bowl.



An object travelling too slow will fall to Earth

At the right speed the object orbits the Earth

An object travelling too fast will escape Earth's gravity well

Thanks to Einstein, we didn't need to imagine gravity as an invisible force that pulled objects together. Instead, gravity is just the effect objects have on the Universe around them.