



Black Holes and the Nature of Space-Time

Where gravity wins, light can't escape and time slows down

How a black hole forms

1

A giant star runs out of fuel

Many times heavier than the Sun

2

Its core collapses

Gravity crushes it inward

3

An event horizon forms

The point of no return

4

Nothing comes back out

Not matter, not light

Event horizon

Not a surface, just the boundary past which escape is impossible.

Milestones

Year	Discovery
1915	Einstein's general relativity describes gravity as curved space-time
2015	LIGO detects gravitational waves from two black holes merging
2019	First image of a black hole, in galaxy M87
2022	Image of Sagittarius A*, the black hole at our galaxy's center

Sagittarius A* holds about 4 million times the Sun's mass.

Gravity bends time



Clocks run slower near mass

Time passes a bit slower closer to Earth



GPS must correct for it

Without the fix, positions would drift miles a day



Extreme near a black hole

Time nearly stops at the horizon, as seen from far away



Squeeze Earth

It would become a black hole under an inch across

Sources: NASA; Event Horizon Telescope; LIGO

Remember

Black holes show that gravity bends both space and time, and your phone's GPS proves it every day.