

SEE HOW

Satellites Discover Worlds

How do we know stars other than our Sun also have planets?

Chasing Earth's orbit around the Sun, the Kepler Space Telescope searched the Milky Way for hints of planets outside of our Solar System. The satellite uncovered evidence of thousands of strange and wonderful new worlds in its decade of service.

WHAT YOU'LL DISCOVER

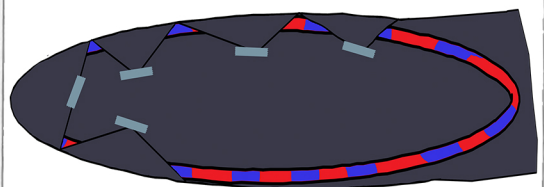
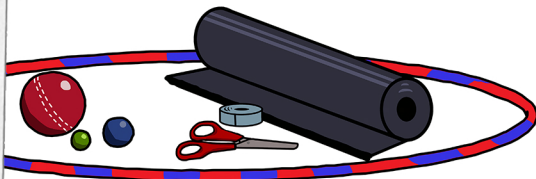
There are many ways to tell if a star has planets. One way is to look at its change in brightness. Another is to measure how much it wobbles – what we call its radial velocity.

How to build

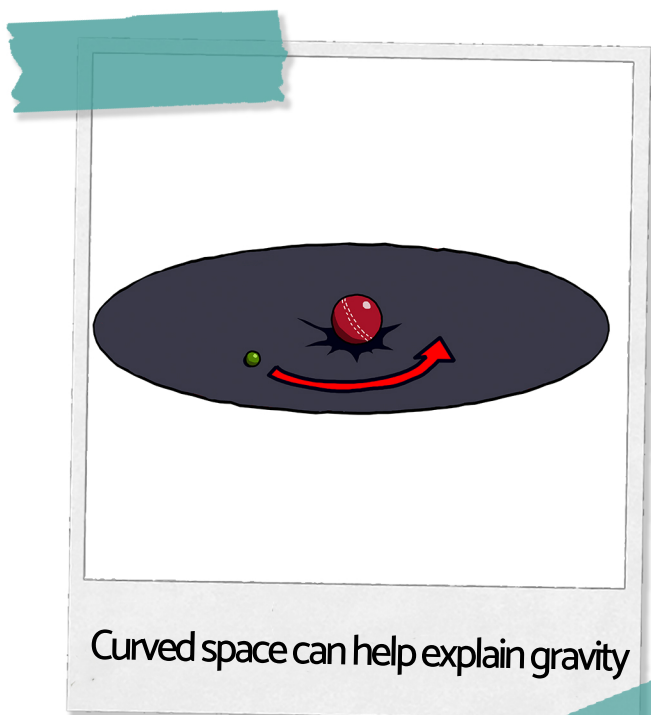
1. Place the hula hoop onto the garbage bag.
2. Cut six pieces of sticky tape, each roughly 5 to 10 cm in length. Lightly attach their ends to the edge of a table or chair for easy retrieval later.

What you need

- A hula hoop
- A garbage bag (large enough to cover the hula hoop)
- Sticky tape
- Scissors
- Several round objects of various masses (e.g. marble, golf ball, cricket ball)
- Two chairs



3. Pull one side of the garbage bag so it is tight against the hula hoop, and fold it over the top. Secure it in place with a piece of tape.
4. Move around the circumference of the hula hoop, pulling the bag tight, folding it over, and securing it in place.
5. Once all sides are pulled tight, turn the hula hoop over. You should have a fairly smooth plastic surface pulled taut like a drum skin.



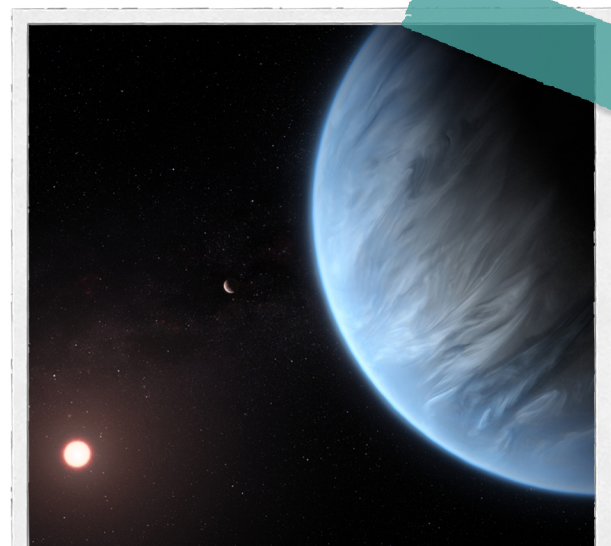
Curved space can help explain gravity

How to use

1. Position the two chairs so they are facing each other, separated by a distance that is slightly less than the diameter of the covered hula hoop.
2. Place the edge of the covered hula hoop on the two chairs.
3. Select the heaviest of your round objects, such as a cricket ball, and place it in the middle of the hula hoop. Press it down gently so the plastic bag

sags slightly – it needs to form a shallow depression.

4. Select the lightest of your round objects. Roll it gently from one edge of the hula hoop, aiming it so it misses the object in the centre. Watch how it rolls along the surface. What shape does it make as it 'orbits' the large object?
5. Watch the object in the centre as the smaller one passes. Does it move?
6. Position yourself so the hula hoop is at eye level. How much of the object in the centre is visible as the rolling object passes in front of it?
7. Try swapping different round objects. Which ones move when they're in the centre?



Exoplanet K2-18b illustration (ESA)

HOW IT WORKS

While space has three dimensions, your model only has two – back and forth, and left and right. But just as that flat plastic is curved, 3D space also has curvature. According to Einstein's theory of general relativity, this changing geometry of space and time explains gravity.

Even with a powerful telescope, the glare of a distant star makes it too bright to see even its largest planets.

But planets can make themselves known by their orbits. As you saw in your model, an orbit isn't always a perfect circle, so astronomers can use the unique timing of these patterns to spot the planets.

The Kepler Space Telescope captured light from a large number of stars over long periods. These timelines of star brightness were then studied for signs of a passing planet blocking some of its light.

Another way of detecting an 'exoplanet' is to watch for the star's movement. Heavy objects, like a big fat planet, can cause it to move around noticeably under the effects of the planet's gravity.

