How do we define distance in space?

Of course, we cannot use a giant tape measure, but astronomers rely on a variety of methods to determine how far something is from Earth. However, the answer is stickier than which method to use. On such a vast scale, the word “distance” does not have a single definition.

Consider this: Billions of years ago, a hypothetical galaxy was 5 billion light-years from Earth. You might think its light would only take 5 billion years to reach us.

BUT the universe is expanding and the space between galaxies is growing. The light has to travel farther than 5 billion light-years to catch up with our galaxy. By the time it reaches us, the universe has expanded so much that the two galaxies could now be 10 billion light-years apart.

Distances in the universe are only correctly described using Einstein’s General Theory of Relativity. But for simplicity, in this exhibit we use the distance that light actually traveled to describe the distance from Earth.