[Albert Einstein](https://www.space.com/15524-albert-einstein.html)'s 1905 theory of special relativity is one of the most important papers ever published in the field of physics. Special relativity is an explanation of how speed affects mass, time and space. The theory includes a way for the [speed of light](https://www.space.com/15830-light-speed.html) to define the relationship between energy and matter — small amounts of mass (m) can be interchangeable with enormous amounts of energy (E), as defined by the classic equation E = mc^2.

Special relativity applies to "special" cases — it's mostly used when discussing huge energies, ultra-fast speeds and astronomical distances, all without the complications of [gravity](https://www.space.com/classical-gravity.html). Einstein officially added gravity to his theories in 1915, with the publication of his paper on [general relativity](https://www.space.com/17661-theory-general-relativity.html).

As an object approaches the speed of light, the object's mass becomes infinite and so does the energy required to move it. That means it is impossible for any matter to go faster than light travels. This cosmic speed limit inspires new realms of physics and science fiction, as people consider travel across vast distances.

Before Einstein, astronomers (for the most part) understood the universe in terms of [three laws of motion](http://www.livescience.com/46558-laws-of-motion.html) presented by Isaac Newton in 1686. These three laws are:

1. Objects in motion or at rest remain in the same state unless an external force imposes change. This is also known as the concept of [inertia](https://www.livescience.com/46559-newton-first-law.html).
2. The force acting on an object is equal to the mass of the object multiplied by its acceleration. In other words, you can calculate how much [force](https://www.livescience.com/46560-newton-second-law.html) it takes to move objects with various masses at different speeds.
3. For every action, there is an [equal and opposite reaction](https://www.livescience.com/46561-newton-third-law.html).

Newton's laws proved valid in nearly every application in physics, according to [Encyclopedia Britannica](https://www.britannica.com/science/relativity). They formed the basis for our understanding of mechanics and gravity.

But some things couldn't be explained by Newton's work: For example, light.

To shoehorn the odd behavior of light into Newton's framework for physics scientists in the 1800s supposed that light must be transmitted through some medium, which they called the "luminiferous ether." That hypothetical ether had to be rigid enough to transfer light waves like a guitar string vibrates with sound, but also completely undetectable in the movements of planets and stars.