

EINSTEIN'S THEORY OF RELATIVITY

GENERAL RELATIVITY THEORY



Group3&9
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The special relativity theory

- The special relativity theory was posted 10 years before the publication of general relativity theory. it is an explanation of how speed affects mass, space and time.
- Special relativity theory is based on two postulates:
 - The laws of physics are the same for all reference frame moving at constant speed.
 - The speed of light is constant for all observers either moving or in state of rest.



Equivalence principle

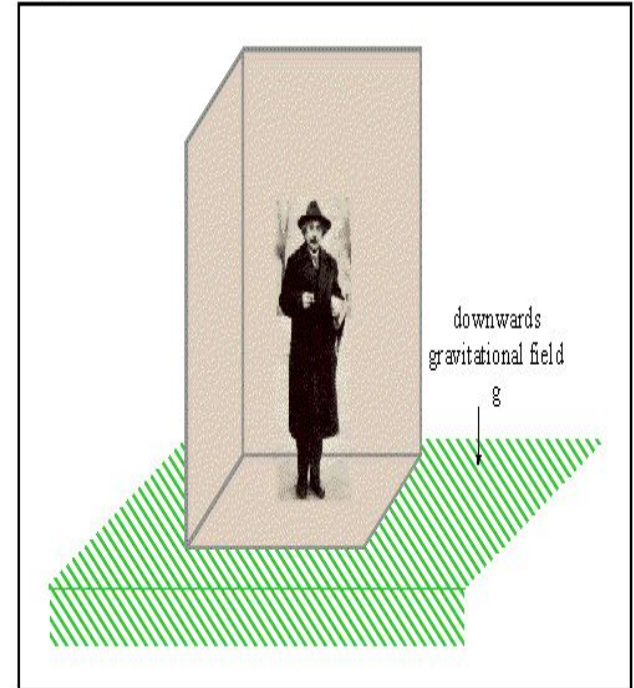
- ✓ something moving (upward at 9.8m/s^2) in space with no gravity has the same mass as something on earth that is not moving.
- ✓ Einstein realized that the observer would not be able to tell if he is on a space ship or on the surface of the earth. This is called the equivalence principle

Equivalence Principle

A



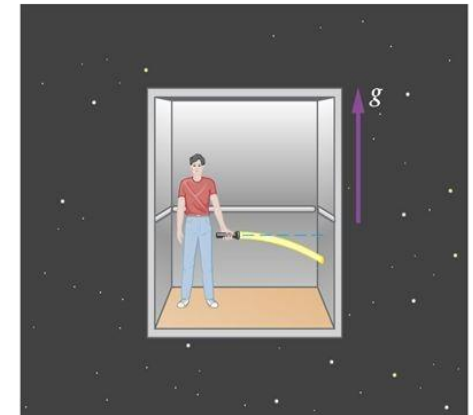
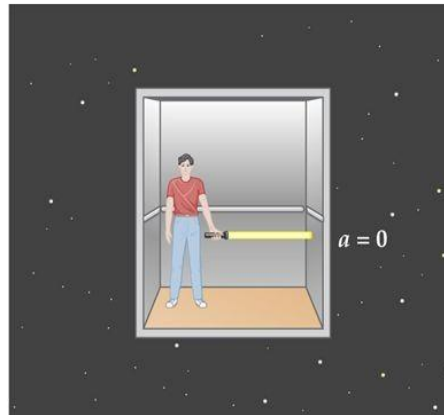
B



Light bending

- According to the principle of equivalence, The beam of light in gravitational field must also bend down, then Einstein concluded that gravity bends light. This is the basis of general relativity theory

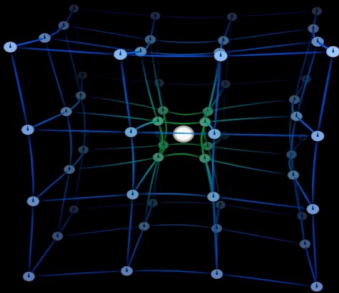
When the elevator is moving at a constant speed, the light from the flashlight travels in a straight line. When the elevator accelerates, the light bends.



Space time

Space time is a model that combines the three dimension of space and one dimension of time into a single four dimensional fabric

Einstein's theory suggested that the space curves due to the gravity of the planet. The space can be assume like a web on which some heavy objects were kept. this is called **space time distortion**



***Massive objects
distort space time***



General relativity theory

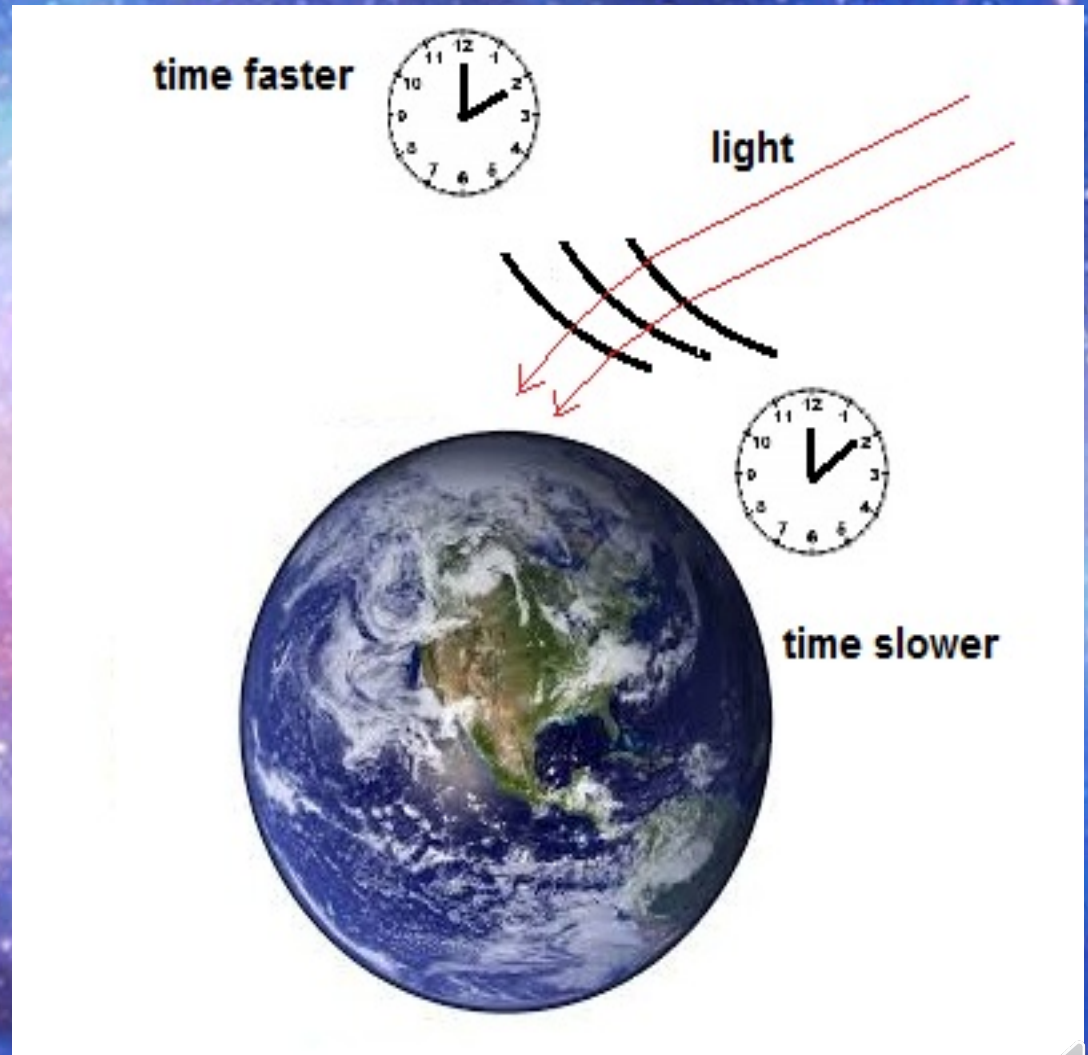
- According to Einstein objects warped space time around it, causing it to become curved and as a result objects experience gravitational attraction to each other. This warped of space time explains how objects behave as they move through space. This is called **general relativity theory**, which was posted in 1915.
- Einstein explained that gravitational attraction is not a force that act from a distance, rather it is something that emerges from the interaction of space time and massive objects.



Gravitational time dilation

- Time moves slowly when you are near massive objects and faster when you are far from massive objects (like the sun, earth).

Eg. Time for us on earth is slower than the astronauts on the ISS.



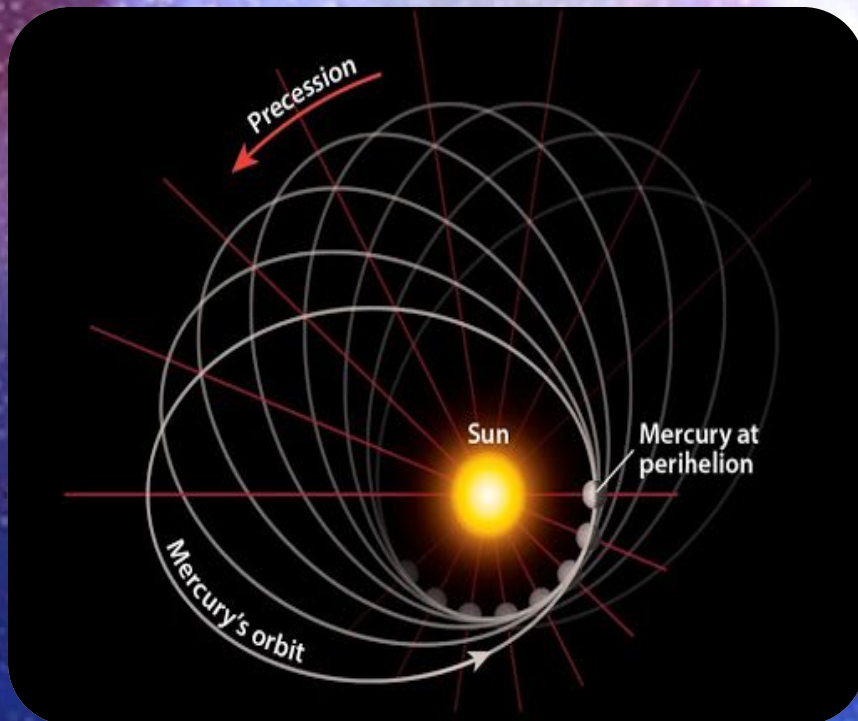
Time travel

- Time slows down for objects traveling close to the speed of light
- Time stops all together for objects traveling at speed of light
- time must go back ward for objects traveling faster than speed of light, but it would take infinite amount of energy for an object to achieve the speed of light.
- When object are moving close to the speed of light , not only the time slow down but, the object itself contracts. This is called **length contraction**.



Mercury's precession

Mercury's ellipse never closes the point of the orbit that was farthest from the sun advances a little bit every time. It's as if the orbit itself is orbiting the sun.



When Einstein applied his general relativity theory to this orbit the new theory predicted exactly the precession that mercury actually has.