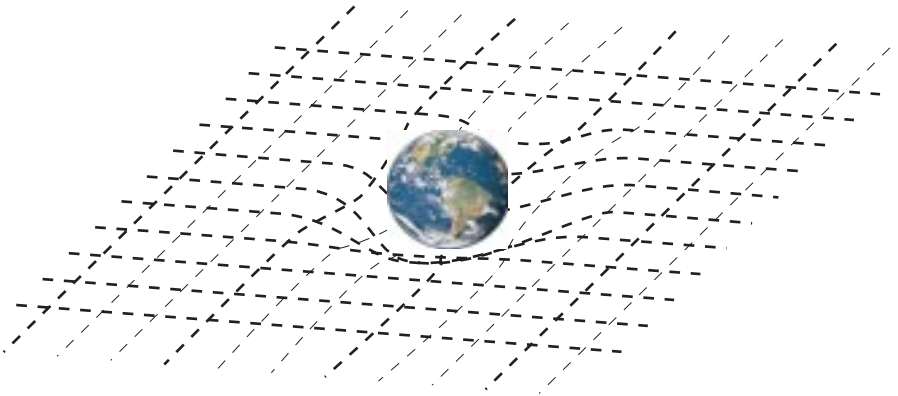


From Newton to Einstein: Understanding "Gravity" as the "Structure of Spacetime"

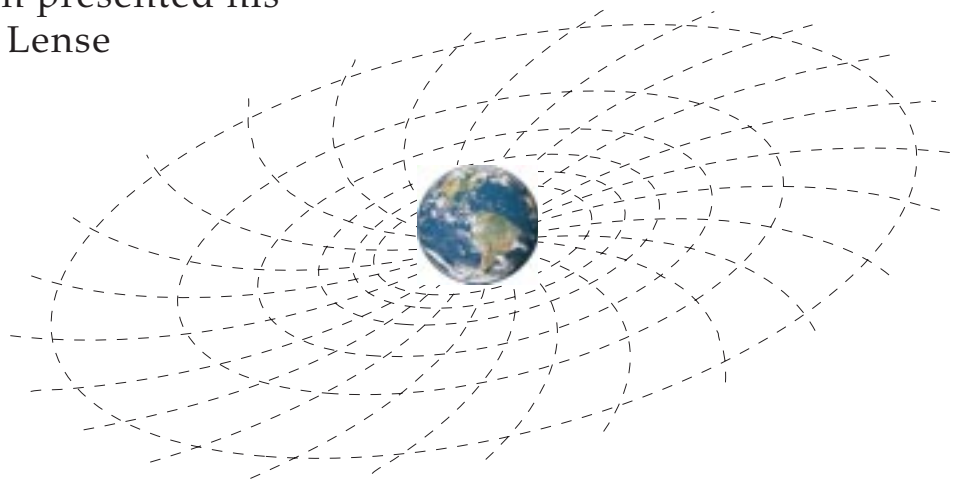
In Newton's theory of gravity, masses, like the Sun, reach out across enormous distances and "pull" smaller masses, like planets, comets, and asteroids, into orbit using their force of gravity. The larger the mass, the greater the force of attraction.

In Einstein's theory of general relativity, space is transformed from the Newtonian idea of vast emptiness with nothing but the invisible force of gravity to rule the motion of matter, to an ephemeral fabric of spacetime, which "grips" matter and directs its course through the universe.



Matter follows the structure of spacetime whether it is flat, as in areas far from any large masses, or when it is curved near large masses. Planets, like the Earth, create "depressions" in spacetime due to their mass. Matter that orbits a planet, like moons or the International Space Station, are simply following the curve of spacetime. (Imagine a large bedsheet with a heavy mass in the middle of it. If you roll a small ball across the sheet, it will follow the curve of the sheet toward the heavy mass.)

In 1918, two years after Einstein presented his theory of general relativity, W. Lense and H. Thirring predicted another connection between large masses and the structure of spacetime -- the idea of "**frame-dragging**". They predicted that when massive bodies in the universe rotated, they dragged spacetime ever-so-slightly around with them.



This idea is not very complex. When Earth rotates, its spacetime frame turns slightly with it. As one goes farther from earth, the spacetime twists less and less, until there is no effect. The effect of the Earth slightly pulling its spacetime frame around with it is called frame dragging.

(A classroom model of frame-dragging is available at our web site.)