John Hall (May 1, 2019 Revision), Litchfield Park, AZ 85340, USA,

This Time - Gravity is Push Not Pull

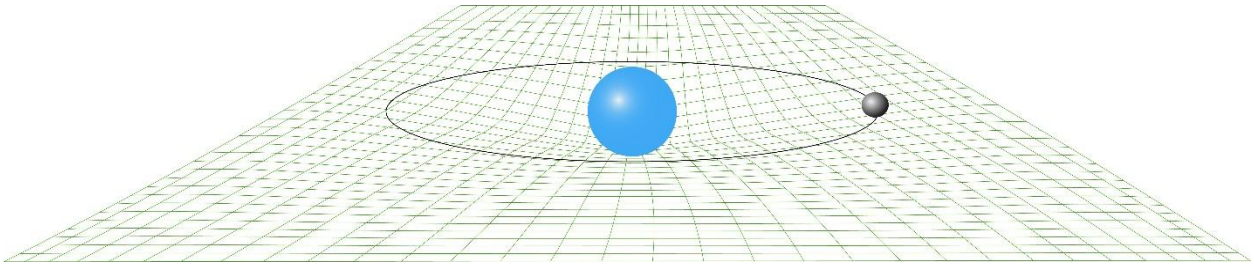
Einstein brought space and time together over a hundred years ago. The fabric of space has been used to describe the effects of gravity ever since. The mathematical forces of gravity can be easily measured, and look something like this:

$$F = G\frac{m_1 m_2}{r^2}$$

F – Magnitude of the force between the objects
G – Gravitational constant (6.7E-11 m3 s-2 kg-1)
r – Distance between the two objects
m – Mass of object 1 and object 2

On Earth, the math works out to 9.8 m/s as the force of gravity. That is not in dispute. The big question is what causes gravity, and where does it come from?

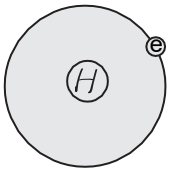
Einstein explains gravity as mass distorting the fabric of space, causing a gravity well that causes objects to continuously fall towards the greater mass. Much like a bowling ball in the center of a trampoline and marbles spinning around the center mass being held away by centrifugal force.



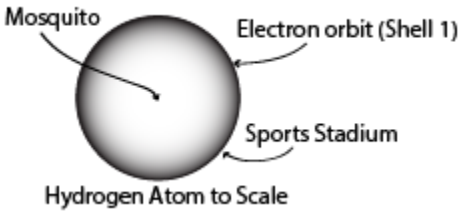
The bowling ball example only works on Earth, where the force of gravity is in one direction, down. In space, there isn't an up or a down, so the continuous falling into a gravity well does not paint an accurate picture of the force of gravity caused by the warping of the fabric of space. I offer an alternative explanation that looks something like this:

In order to get the full picture of what causes gravity, we need to begin with the very small and the fabric of spacetime. I believe Einstein's theory that gravity is the warping of the fabric of spacetime, but the reason for the warping may be described differently.

Until recently, the space between the nucleus of an atom, and the electron shells surrounding the center was not fully understood. The size and scale of atoms can now be compared to a mosquito in the center of a sports stadium as the nucleus and the outside of the stadium as the first orbiting shell.



Hydrogen Atom

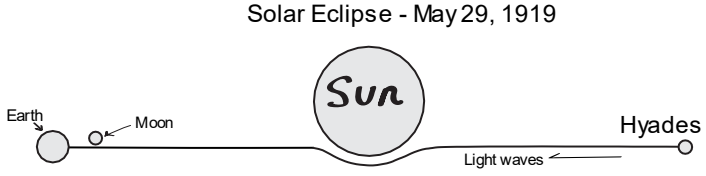


Hydrogen Atom to Scale

Imagine the fabric of space, beginning with the space between the orbits of electrons in an atom, bringing the fabric of spacetime down to the atomic level. There are specific numbers of electrons that can occupy different layers or orbits around the nucleus of every atom. As the number of protons and neutrons increase, so do the orbits and electrons surrounding the atom. The heavy atoms have more protons and neutrons, and an enormous amount of space between the outer shell and the center of the nucleus relative to the size of the atom. It is commonly understood that the force that holds the electrons in orbit is an electromagnetic force. I submit that the layers of the fabric of spacetime contributes to the order and layers of atoms, and ultimately forms the pressure of gravity pushing form the outside inward, not a mystical graviton particle pulling to the center of mass.

If no two things can occupy the same space at the same time, and matter displaces the fabric of spacetime outward in all directions, ultimately the fabric of space is the force pushing back, causing the effects of the forces of gravity.

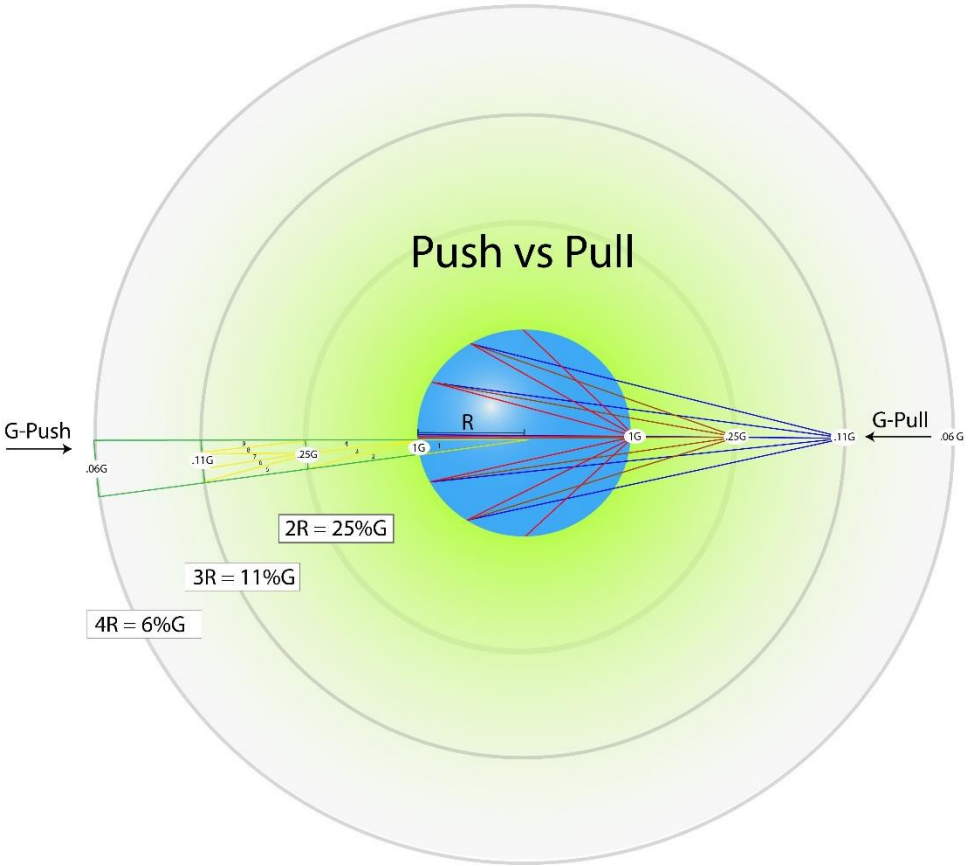
Therefore, gravity is the force of the displacement of the fabric of spacetime relative to the density and mass of an object. In other words, the Earth does not pull you in, the pressure of the fabric of spacetime is pushing you to the center of the mass. Einstein predicted this warping of space with his theory of General Relativity in 1916, but it took another 4 years for someone to prove it. Sir Arthur Eddington's negative photograph captured the group of starts (Hyades) that were positioned behind the sun at the time of the eclipse.



This was the first evidence of the effects of mass on the fabric of spacetime, but I believe a gravity bubble, instead of a gravity well, is a more accurate way to describe the warping of space. Imagine the force of gravity as near infinite bubble layers of pressured (displaced by mass) spacetime. As you travel farther from the surface of the Earth, the effects of gravity diminish greatly. The reasons for the disproportionate ratio of distance to force cannot be easily explained but looking at the forces of gravity as a pushing force rather than a pulling force is one explanation.

Assuming gravity is a force caused by mass, the force of gravity at the surface of Earth is measured at 9.8 m/sec^2 (1G). If the mass of the Earth is pulling on other objects, then at the surface of the Earth the force

would be the average of the forces pulling from many angles, as shown in my Push vs Pull illustration. The entire mass of the Earth would be contributing to any gravitational force, including the mass past the center and from all side directions. That makes perfect sense. The problem arises when you pull away from the center of the mass and the effects of the gravitational force diminish at a disproportional rate. By moving away from the surface of the Earth the distance of one radius (the distance from the surface to the center), the forces of gravity are reduced to one quarter of the force on the surface (.25G). Twice the radius equals 11% (.11G), and three times the radius from the surface works out to a mere .06G, which is only 7% of the distance to the moon. The relatively small distance away from the surface doesn't seem to justify the loss of force.

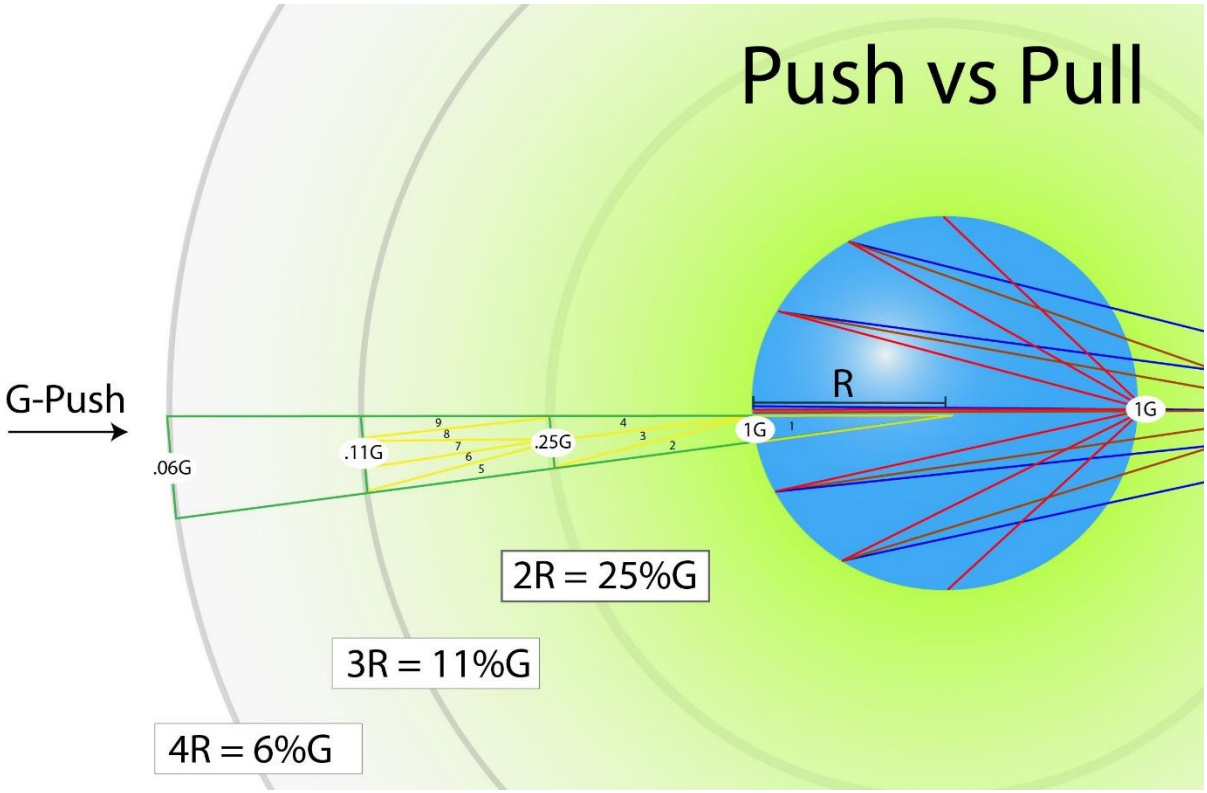


Now consider an alternate explanation. If the force of gravity is a result of the warping of the fabric of space, just like Einstein predicted, but instead of a gravity well, there is a pressure sphere surrounding the mass caused by the displacement of the fabric of space outwardly from the center of the mass. Density and volume would have the same effects on the gravitational forces with the push or pull theories, but the reasoning for the distance diminishment becomes evident with my push theory.

In order to better visualize the G-Push effect, imagine a pie sliced section of the Earth labeled "1" in the illustration with the force of 1G at the surface. Since all the gravitational forces are coming from all angles pointing towards the center, all points at the surface are at 1G, with all forces pointing directly at

the center of the Earth. Once you move away from the surface of the Earth to the distance of 1 radius from the surface, the effects of gravity are once again reduced to 25% (.25G) to that of the surface.

By extending the pie slice outward into space, the diameter of the pressure sphere increases, and the dilution of the pressure of the fabric of space occurs. It is like rising from the depths of the ocean. The pressure that was above is now below, making the volume of the force no longer acting upon an object somewhat proportionate to the distance from the center. You can approximate three pie slices will fit into the volume of the second radius sphere, which coincides with the distance and force reduction ratios. As the distance from the center of the mass increases, the volume of the pressure force (gravity) is diluted.



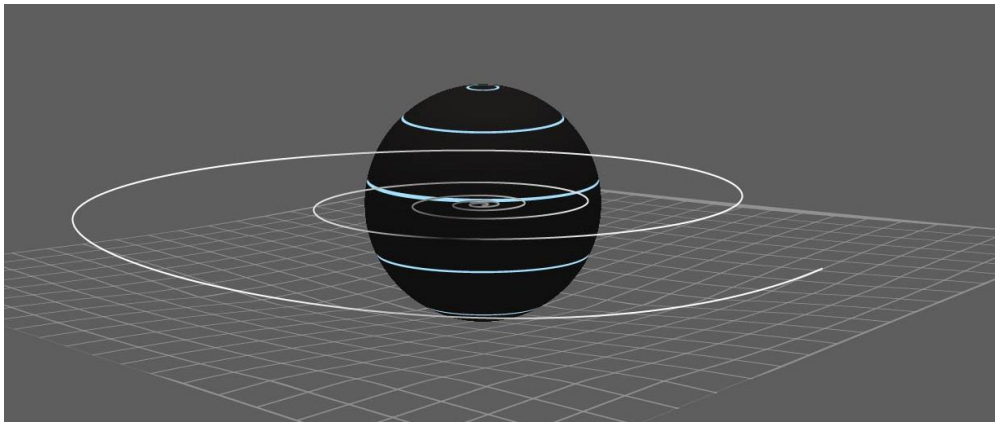
Black Holes, Light, and Gravity

Black holes and dark matter would be good examples of the lack of space between particles of matter. If black holes are the product of collapsed stars, or even matter that didn't get created into atoms from whatever beginning there was, it is evident the warping of space is tremendous. So much so, that nothing can escape, not even light. That may not be entirely accurate.

Consider the moments of a massive star before the fuel of the star (Hydrogen and Helium) runs out, and the event of becoming a black hole is soon to begin. The volume (or diameter) of the star would likely be very large, and the star would also most likely be spinning at some rate of speed. The earth, for example,

rotating one revolution in 24 hours, has a surface speed of about 1,000 miles per hour. The bigger the diameter of the star the faster the outer most portion of the star is traveling. Once the fuel gets to the point where the mass of the star can no longer support the volume of the star, collapsing of the star begins.

Much like a figure skater spinning around with their arms initially spread out and as the skater brings the mass of their arms inward, the spinning rate increases, dramatically. Due to the conservation of angular momentum, as the radius decreases the linear velocity increases proportionately. As the star collapses into itself, the rotation rate of the star can reach several hundred revolutions per second, making the surface of the mass reach speeds up to 84% the speed of light, which is just over 150,000 miles per second.



If you imagine a super massive black hole spinning hundreds of times per second, the speed of the surface at the equator would be pushing the speed of light. This event is not an imaginary thought experiment, but actual matter traveling at an extraordinary rate of speed. The black hole NGC 1365 is reported to be spinning at 84% of the speed of light. That's around 150,000 miles per second. If light travels at 186,000 miles per second, then very little light would have any chance of reflecting. If the former star is no longer emitting its own light, then any light coming from the now black hole would now only be reflected light. The reflected light would be diminished by the speed of the reflecting surface, making whatever light reaches the surface has very little chance of reflecting outwardly.

There are several other factors involved in considering the properties of black holes and how they effect light and gravity. We can readily understand a super massive black hole in the center of every galaxy, holding the spinning mass of gas, stars, and solar systems together like one big family. We can also see the effects of what appear to be an unseen force causing stars to orbit around it like comets around the Sun.

First, imagine a star much like our own reaching the end of its life cycle 5 billion years from now, collapsing into itself and becoming a small black hole about 5 miles wide. Although our sun does not have enough mass to become a black hole, the mass as a star is greater than the mass as a black hole. Any planets, gases, stars, solar systems, or galaxies that weren't heading to the new black hole buffet before the star became a black hole would certainly not change course and head to something that has less gravity. If anything, the remaining planets orbiting our former sun would increase their distance from the former Sun.

Now consider the gravitational forces of any mass, including black holes. The forces of gravity are inversely proportionate to the distance from the center of the mass. For every mile you travel away from a massive black hole, the warping of the fabric of space and the force of gravity diminishes greatly. Since light has no mass, the only effects gravity would have on light would be the curvature of the warped fabric of space that the light is traveling through. Light emitted from stars and galaxies from behind the black hole would be visible do to lensing, and there would be a phenomenon like that of an atmosphere as what is commonly called the event horizon. The event horizon in general relativity is a region in spacetime beyond which events cannot affect an outside observer. The theoretical point of no return.

The event horizon is thought of as the point where gravity is too great for anything, including light to escape. That would be assuming you are observing the surface of the black hole from a stationary position. Imagine a traveler in a spacecraft capable of reaching speeds near the speed of light. While the traveler is orbiting over the Earth, traveling at speeds of over 400 miles per second (that's 24,000 miles per hour) the effects of gravity from the Earth are negligible as centrifugal force and gravity are cancelling each other out. Now imagine the traveler has made the long journey to the nearest black hole and wishes to get as close as possible for that magical selfie with a black hole in the background. If the traveler is visiting the black hole NGC 1365, an approach speed of 150,000 miles per second (9,000,000 miles per hour) would be necessary to match the speed of the surface of the black hole. At that speed, the effects of the enormous gravitational forces upon the traveler would not be noticed, until the sudden stop at the surface of the black hole.

With a high approach speed into a black hole there wouldn't be any stretching or shrinking of space or time. The traveler would already be traveling near the speed of light, so all the image delays and time distortions from an observer's point of view of the traveler would have already taken place. The images of time appearing to stop will be apparent by the observer, but they would be the same as my Moon and LED clock example, just delayed images. The traveler would have aged the same amount as the observer, all the way up to the point of impact.

Einstein's "elevator" thought experiment explained the lack of feeling gravity's pull while falling in an elevator, and Douglas Adams quote "It's not the fall that kills you; it's the sudden stop at the end", sum up the event of a traveler passing through the event horizon.

Centrifugal force and gravity may also play major roles in the area of the event horizon. Centrifugal force may be acting upon the mass of the black hole, preventing the enormous mass from becoming a 100% singularity (void of space), increasing the radius of the black hole, and therefore decreasing the effects of gravity itself near the surface of the black hole.

Einstein's theories do not prevent anything with mass to travel close to the speed of light, but his formulas imply infinite energy is required. The energy of a black hole spinning at enormous speeds is kinetic energy, which is keeping in line with all of Einstein's relativity formulas. The reasons black holes cannot spin faster than the speed of light may be many, including centrifugal force. When Einstein used the speed of light as the universal constant in his formulas, the relativity factor becomes the limitation of anything beyond the speed of light.