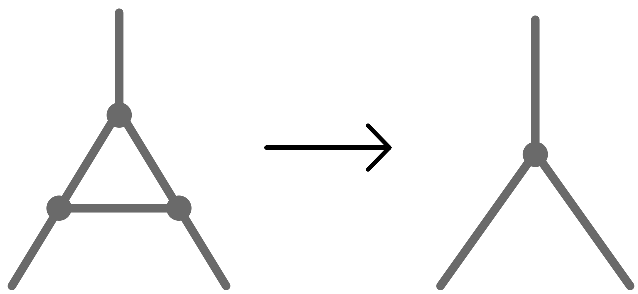
Mechanical Gravity Theory



Mechanical Gravity Theory proposes a mechanism for gravity and the expanding universe. It is based on the model of physics presented by Stephen Wolfram in *A New Kind of Science.*

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Mechanical Gravity Theory

I propose that gravity is the macroscopic expression of the tendency for particles with mass to be net consumers of nodes, and empty space to be a net producer of nodes. This theory is an extension of the model of physics presented by Stephan Wolfram in *A New Kind of Science*.

According to Wolfram's view of fundamental physics, the universe is made of a trivalent network of nodes and connections between nodes. These nodes correspond with the smallest possible unit of spatial measurement – the Planck length, about 10^{-33} centimeter. In this model, distance is measured as the count of nodes along the shortest path between two objects. An object's volume corresponds to the number of nodes that make up the object.

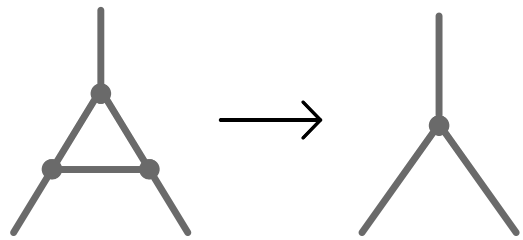
The evolution of the network is based on a set of simple replacement rules that have yet to be discovered. Each time the rules are applied, time has passed. It is important to note that the passage of time is discrete, corresponding to the Planck time of 10^{-43} seconds.

In this model, a particle is a collection of nodes with features that persist as the network evolves. This persistence is why an electron remains an electron as time passes. Empty space refers to areas of the network that do not contain persistent structures identifiable as particles.

It is interesting to note that there is some ambiguity as to which nodes belong to a particle and which nodes belong to the empty space around the particle. As the network evolves, nodes that begin as part of empty space can find themselves as part of an elementary particle later on. The converse is also true, nodes that begin as part of a particle can become part of empty space.

Certain rules reduce the total number of nodes in the network when they are applied.

For example:



When this rule is applied, exactly two nodes cease to exist.

Now imagine that this reducing rule tends to be applied more in massive particles than in empty space. This means that massive particles absorb more nodes from free space than they return back to free space. Thus the particle is essentially sucking in and consuming the space around it.

A particle's consumption of nodes reduces the amount of empty space around the particle, producing the macroscopic force of attraction we perceive as gravity. As a massive particle pulls the fabric of space into itself, objects that exist in the fabric become closer to the massive particle. An object falling toward a mass does not experience acceleration because the object is not accelerating relative to its surrounding space. Instead, space itself is moving toward the particle.

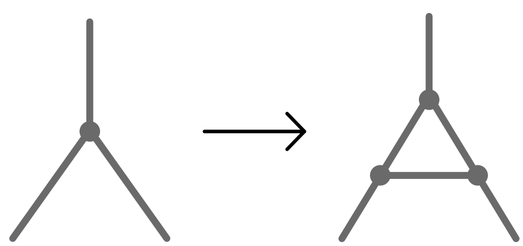
There is a direct relationship between a particle's likelihood to reduce node count and the particle's mass.

This formulation of gravity does not require the existence of a force-carrying particle such as the graviton, which has so far eluded discovery.

The Expanding Universe

I predict that space is an overall producer of nodes. As nodes are added throughout empty space, the volume of the universe expands, and all particles are pushed apart from one another. This predicted expansion is consistent with the experimental observation that the universe is expanding.

For example, the following rule adds exactly two nodes when it is applied:



By building expansion into the mechanism of space itself, there is no need to explain the expansion of the universe in terms of dark energy. Empty space produces more empty space, so as the amount of empty space increases, the rate of expansion increases as well. This matches the experimental observation that the expansion of the universe is accelerating.

General Relativity

This theory can be made to explain the experimental outcomes predicted by General Relativity, such as the slowing of time near gravity sources. However, it requires rethinking the notion of time dilation accepted since the 1930s.

I propose that time is a constant, and that distance dilation produces the effects we have perceived as time dilation. At a point of high gravity, time is not slower, distance is longer. This misunderstanding of time dilation comes from the way we perceive the passage of time.

Let's begin by reviewing the process of perceiving the passage of time. Broadly speaking, for us to perceive the passage of time, we depend on witnessing some perceptible change in our environment. This could be the everyday process of watching a clock's second hand move forward, or a particle accelerator's detection of a particle. Even the most fundamental observation of the passage of time is preceded by a large number of particle and virtual particle interactions. Consider the cesium atomic clock: this device requires a myriad of sub-atomic particles interacting to produce its macroscopic representation of time.

Now imagine that the average distance each particle had to travel before it interacted with the next particle in the system is increased. Assuming the particles are traveling at the same average rate, this increase in distance will cause the subatomic process to happen at a slower rate. According to Newtonian mechanics, this makes perfect sense –if you have further to travel at a constant rate, it takes longer to get there.

Why would particles at a point of high gravity have a greater distance to travel? Because gravity curves space-time, which in turn curves a particle's trajectory. This means that a particle must take a more curvy and convoluted path between interactions. A place of high gravity has many obstacles that must be navigated before an interaction takes place.

The most extreme case of distance dilation is orbit. If all particles are locked in binary orbit, time has effectively stopped as far as we can perceive it. To some degree, this is the picture you would see at the center of a black hole, where it is predicted that time essentially stops due to the extremely high gravity.

Conclusion

I imagine that for Mechanical Gravity to be fully tested it first requires the discovery of Wolfram's rule for the universe. Until then, smaller steps can be taken, such as looking for network update rules which produce convections toward non-accelerating vectors. Looking for the cosmological constant in a system's growth rate could provide a good litmus test for a candidate rule for the universe.

Gravity may prove to be the ultimate strange attractor.