Self-Organizing Fractal Noise in Space-Time

by Sven Nilsen, 2020

In this paper I discuss potential applications of self-organizing fractal noise in the study of space-time, using the boundary between connected space-time regions that contains different physical laws.

The uniformity of space-time is often taken for granted, but there exists scientific evidence for cases where the nature of this uniformity is put into question. One such case is the application of Hawking radiation to black holes. The basic principle of a black hole is that it is impossible for a traveling observer crossing the event horizon to send back information to an outside observer.

Black holes are physical phenomena where some boundary of space itself is observable.

Due to Einstein relativity, the events that happen near a black hole are time dilated relative to the outside observer. This means that objects move slower and slower internally when approaching the speed of light, to the extent that describing what actually happens inside the black hole becomes meaningless. The paradoxical nature that something moves slower, the faster it moves, is due to counter-intuitive properties of Einstein relativity. This results in some common misconceptions.

To resolve these common misconceptions, I have to be more precise how I use language. When I say “an object entered a black hole”, what I really mean is that the object approached the black hole and vanished from sight. The space-time at the event horizon curves so much, that coordinates moves faster than speed of light relative to the outside observer. Photons get red-shifted until it is impossible to measure their frequency. Since everything observers experience is based on coordinates moving slower than speed of light, it becomes impossible to imagine what happens inside. This is counter-intuitive, since when imagining something we automatically assume non-relativity.

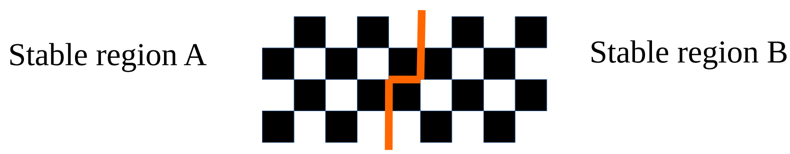
The moment when a small object enter a black hole, only lasts an instant to the outside observer. However, if you imagine a small spinning disc entering a black hole, its rotation will slow down until it stops entirely. In a simplified model, one can think of rotating movement slows down, while the translation of the spinning disc moves at the speed of light relative to the outside observer.

Therefore, in translation terms, it is possible to change the coordinate system. If the outside observer follows the inside observer falling into the black hole, then instead of being stationary relative to the event horizon, the location of the event horizon will seem to move and one can observe the first object who enters the event horizon a little longer. However, almost everything will be dark, so it will be difficult to tell the difference without using a clock.

The closer one follows the first object, the longer it can be observed. In the limit this means that nothing unusual seems to happen at the event horizon relative to a stationary outside observer.

Therefore, the boundary of space that is observed around black holes, is a boundary relative to the observer and therefore technically not a "real" boundary. This is important to understand when talking about what it means for space to have a different kind of boundary.

In the simplest model of self-organizing fractal noise, there are 2 stable solutions that is expected long-time behavior of space. Both solutions are almost identical, except a phase-shift relative to each other.



Boundary between stable regions

The boundary between the stable regions is unstable and changing over time. The closer one moves toward the boundary, the higher probability there is to end up in an unstable state.

One can imagine the possibility that the uniformity of space-time is a result from a similar process that yields some solutions of physical laws which are relatively stable. If this process has multiple solutions that are phase-shifted relative to each other, one would expect that the boundary has a fractal shape instead of a "smooth" boundary as the one found around black holes. In the boundary between these two solutions, the space itself bends and twists with violent force, generating gravitational waves.

It is currently unknown what kind of effect gravitational waves generated from such a boundary would look like. One hypothesis is that the gravitational waves will have many frequencies and therefore appear to be a kind of "background noise".

If theoretic models were developed to describe a plausible fractal boundary in space-time between regions of stable uniformity, then it might be possible to predict the signal in graviational waves and detect them from Earth.

In summary, the boundary between two stable regions of space-time:

- Has physical laws that are phase-shifted relative to each other
- Would be shaped like a fractal
- Would become more and more unstable the closer one approaches the boundary
- Would bend and twist space itself, generating gravitational waves
- The gravitational waves might appear as "background noise"
- Might be detected from Earth by developing proper theoretic models