Possible Spacetime Discretization in Astrophysical Phenomena

Vittoria Tommasini

TAPIR, California Institute of Technology, Pasadena, CA

Abstract

We know quantum mechanical rules hold up on the small scale, but we have yet to find a way to connect quantum mechanics with macroscopic systems like black holes. This is one of the biggest questions in physics today. Quantum gravity seeks to combine Einstein's general relativity with quantum mechanics, perhaps finally providing us with this missing link. On the small scale, quantum mechanics tells us energy comes in discrete packets, that it is quantized. What if we can also find discreteness on the large scale, say for space and time? As discussed by many authors, since ancient times philosophers and physicists have asked themselves whether space is continuous, or if it only appears as such, and can be described with discrete models. I have modeled discretized spacetime geometries utilizing causal hypergraphs and studied the trajectories in them to see what would be the signatures of discreteness around black holes.