Physicist suggests 'quantum foam' may explain away huge cosmic energy

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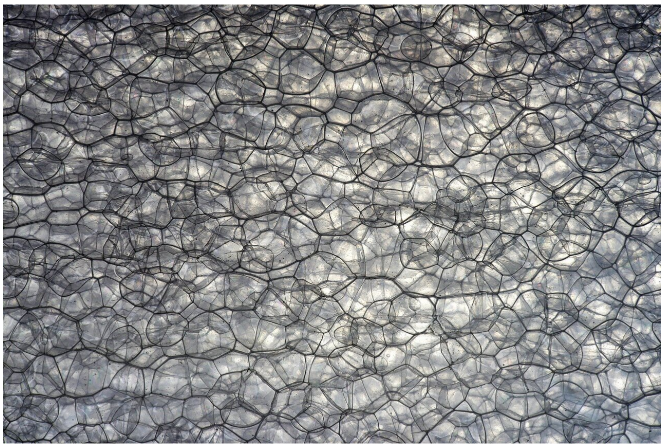

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Steven Carlip, a physicist at the University of California, has come up with a theory to explain why empty space seems to be filled with a huge amount of energy—it may be hidden by effects that are canceling it out at the Planck scale. He has published a paper describing his new theory in the journal *Physical Review Letters*.

Conventional theory suggests that spacetime should be filled with a huge amount of energy—perhaps as much as 10^{120} more than seemingly exists. Over the years, many theorists have suggested ideas on why this may be—most have tried the obvious approach, trying to figure out a way to make the energy go away. But none have been successful. In this new effort, Carlip suggests that maybe all that energy really is there, but it does not have any ties to the expansion of the universe because its effects are being canceled out by something at the Planck scale.

The new theory by Carlip is based very heavily on work done by John Wheeler back in the 1950s—he suggested that at the smallest possible scale, space and time turn into something he called "spacetime foam." He argued that at such a small scale, defining time, length and energy would be subject to the uncertainty principle. Since then, others have taken a serious look at spacetime foam—and some have suggested that if a vacuum were filled with spacetime foam, there would be a lot of energy involved. Others argue that such a scenario would behave like the cosmological constant.

Thus, to explain their ideas, they have sought to find ways to cancel out the energy as a way to make it go away. Carlip suggests instead that in a spacetime foam scenario, energy would exist everywhere in a vacuum—but if you took a much closer look, you would find Planck-sized areas that have an equal likelihood of expanding or contracting. And under such a scenario, the patchwork of tiny areas would appear the same as larger areas in the vacuum—and they would not expand or contract, which means they would have a zero cosmic constant. He notes that under such a scenario, time would have no intrinsic direction.

More information: S. Carlip. Hiding the Cosmological Constant, *Physical Review Letters* (2019). DOI: 10.1103/PhysRevLett.123.131302 . On *Arxiv*: arxiv.org/abs/1809.08277