**Fractal Spacetime from Stochastic Gravity?**

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Many approaches to quantum gravity find that spacetime near the Planck scale (10^33cm) becomes effectively two-dimensional [1]. Recently there are proposals that the structure of spacetime becomes fractal at such a scale [2]. Rather than relying on a postulated theory for the microscopic structure of spacetime as with strings, loops or sets, here we examinine this issue starting from low energy known theories, such as semiclassical gravity [3], where the vacuum expectation values of the stress energy tensor of a quantum matter field act as a source in driving the classical spacetime dynamics. Quantum Brownian motion has been a useful paradigm for the inclusion of matter field fluctuations in the establishment of stochastic gravity [3] based on the Einstein-Langevin equation [4]. When only the two point functions of the stress tensor are included, solutions for the metric fluctuations (“spacetime foam”) have been found for Minkowski and de Sitter spacetimes [5]. Higher moments of the stress-energy tensor have been shown to be just as important which leads to novel phenomena even at today’s low energy [6]. Here we ask the question, would including non-Gaussian noise sources, or higher moments of the stress energy tensor in a self-consistent backreaction study of the spacetime dynamics reveal the underlying fractal structure of spacetime? This is motivated by the anomalous diffusion processes where multi-scale wave operators need be introduced to account for the effects deviating from the usual Brownian motion [7]. This approach offers a useful key to unlocking the mesoscopic behavior of spacetime [8], which is a more meaningful and accessible regime, being the common denominator of all theories of quantum gravity and a connector to more verifiable low energy phenomena.