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Atoms of Spacetime and the Nature of Gravity

A natural guiding principle for gravitational dynamics is that the field equations of gravity should remain invariant when a constant is added to the Lagrangian. This principle uniquely selects the Lanczos-Lovelock models of gravity in D dimensions and Einstein's theory in D=4. More importantly, it leads to a thermodynamic interpretation for several variables (usually considered to be geometrical) as well as for the equation describing the spacetime evolution. Extending these ideas one level deeper, I show how the relevant thermodynamic variational principle can be obtained from a distribution function for the number density of the “atoms of spacetime”. This is based on the curious fact that the renormalized spacetime endows each event with zero volume but finite area!

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