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Quantum gravity effects in spacetimes with a fundamental length scale

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It is a longstanding conjecture that spacetime is emergent from an unknown substructure on an ultramicroscopic scale. While there are many competing models of this sort, a generic question is whether the existence of a fundamental length has any observable consequences. To investigate this, we have examined various quantum field effects within the framework of one such model: Doubly Special Relativity. Here, a type of spacetime discreteness, or pixelation, is reconciled with special relativity by introducing curvature into momentum space. The upshot is that the quantum vacuum is made dispersive, thereby affecting the propagators needed to calculate a variety of quantum field processes, such as the Davies-Fulling-Unruh effect and Hawking Radiation.

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