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Quantum gravitational decoherence from minimal length

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Schemes of gravitationally induced decoherence are being actively investigated as possible mechanisms for the quantum-to-classical transition. In this talk, I introduce a decoherence process attributable to quantum gravity effects. In particular, I assume a foamy quantum spacetime with a fluctuating minimal length coinciding on average with the Planck scale. Considering deformed canonical commutation relations with a fluctuating deformation parameter, it is possible to derive a Lindblad master equation that yields localization in energy space and decoherence times consistent with the currently available observational evidence. Compared to other schemes of gravitational decoherence, one can see that the decoherence rate predicted by this model is extremal, being minimal in the deep quantum regime below the Planck scale and maximal in the mesoscopic regime beyond it. Finally, I briefly discuss possible experimental tests of the model based on cavity optomechanics setups with ultracold massive molecular oscillators and provide preliminary estimates on the values of the physical parameters needed for actual laboratory implementations.

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