A gravitational self-decoherence model and a gentle recovery of the classical world

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We begin by briefly discussing the reductionist program of reclaiming the classical world from quantum physics. Next, we argue that the combination of spacetime theory and quantum mechanics (QM) would preclude the measurement of distances at the Planck scale. This is used to argue that current QM would be unable to describe particles with Planck mass, M_P, requiring a Heisenberg cut to separate quantum particles ($m \ll M_P$) from classical particles ($m \gg M_P$). Finally, a minimal (Lorentz-invariant) gravitational self-decoherence model is presented to anticipate new physics at the Heisenberg cut $m \sim M_P$. In particular, free quantum particles would experience self-decoherence for masses $m \gg M_P$. Although our model prohibits the center of mass of crystals with $m \gg M_P$ from being in spatial superposition, it does not prevent them from hosting phonon superpositions, as seen in the Lab.

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