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Theory: Self gravity affects quantum states

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We study how self gravitation of quantum systems affects the quantum coherence present in their state. Spatial superpositions of static, large, heavy systems tend to rapidly lose coherence, whereas light or massless particles are unaffected. Furthermore, large and heavy objects also rapidly localize into a single classical position. The ratio of the characteristic size of the system and its Compton length determines the onset of the effects, which become significant at a timescale that is inversely proportional to the system's gravitational self energy. Our results can explain two important aspects of physical systems: the possibility of coherently placing individual particles or photons in distant positions, and the difficulty of maintaining quantum coherence between massive objects.

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