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Macroscopic quantum systems and gravitational phenomena

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ABSTRACT

Quantum optical systems which operate at novel scales in terms of mass and size are studied, with an emphasis on exploring the interplay between quantum theory and general relativity. The pulsed regime of opto-mechanics is considered and it is shown how short optical pulses can be used to prepare and characterize quantum states of a massive mechanical resonator, and how some phenomenological models of quantum gravity can be probed. In addition, gravitational time dilation in low-energy quantum theory is studied and the resulting decoherence of composite quantum systems is derived. The results show that the interplay between quantum theory and general relativity affects even low-energy quantum systems and that it offers novel phenomena which can be probed in experiments.

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