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Testing quantum mechanics and quantum gravity with cavity optomechanics DAVID VITALI, Physics Division, School of Science and Technology, University of Camerino — Cavity optomechanical setups represents a promising platform for testing quantum mechanics and its validity at a macroscopic scale. Here we present two different examples. We first show the result of an experiment which, by a high sensitive measurement of the free evolution of the nanomechanical resonator probed by an optical field, has improved by many orders of magnitude the bounds on commutator deformation parameters which characterize a wide class of approaches to quantum gravity. In the second case we propose an experiment able to discriminate unambiguously collapse models, postulating the existence of intrinsic noise which modifies quantum mechanics and is responsible for the emergence of macroscopic classicality, from standard environmental sources of decoherence. In particular, we show that the stationary state of a trapped nanosphere is particularly sensitive, under specific experimental conditions, to the interplay between the cavity size, the trapping frequency and the momentum diffusion induced by the collapse models, allowing to detect them even in the presence of standard environmental noises.

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