Quantum Physics

Demonstration of an ultracold micro-optomechanical oscillator in a cryogenic cavity

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Preparing and manipulating quantum states of mechanical resonators is a highly interdisciplinary undertaking that now receives enormous interest for its far-reaching potential in fundamental and applied science. Up to now, only nanoscale mechanical devices achieved operation close to the quantum regime. We report a new micro-optomechanical resonator that is laser cooled to a level of 30 thermal quanta. This is equivalent to the best nanomechanical devices, however, with a mass more than four orders of magnitude larger (43 ng versus 1 pg) and at more than two orders of magnitude higher environment temperature (5 K versus 30 mK). Despite the large laser-added cooling factor of 4,000 and the cryogenic environment, our cooling performance is not limited by residual absorption effects. These results pave the way for the preparation of 100-um scale objects in the quantum regime. Possible applications range from quantum-limited optomechanical sensing devices to macroscopic tests of quantum physics.

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