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Laser cooling of diffraction limited size micromirrors CONSTANZE METZGER, IVAN FAVERO, KHALED KARRAI, Center for NanoScience, Department of Physics, LMU Munich — The prospect of realizing entangled quantum states between macroscopic objects and photons [1] has recently stimulated interest in laser-cooling schemes of macroscopic mechanical resonators [2-5]. We describe passive optical cooling of the Brownian motion of a cantilevered micromirror. Since the cantilever forms one mirror of a confocal Fabry-Pérot cavity, its mirror end has to be of the size of the optical wavelenght in order to ensure high reflectivity. In our setup, the mirror's size is 2.4μm and hence in the range of the diffraction limit for 1.3μm laser light. With its weigth of 11pg it represents the smallest mass cooled so far. The optically induced excitation regime was also explored, opening a path to optically driving nanostructures with high frequency resonances. [1] Marshall et al., Phys. Rev. Lett. **91**, 130401 (2003). [2] Metzger and Karrai, Nature **432**, 1002 (2004). [3] Gigan et al., Nature **444**, 67 (2006). [4] Arcizet et al., Nature **444**, 71 (2006). [5] Kleckner and Bouwmeester, Nature **444**, 75 (2006).

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