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Using a Laguerre-Gaussian beam to cool and trap the rotational motion of a mirror M. BHATTACHARYA, P.-L. GISCARD, P. MEYSTRE, B2 Institute, Department of Physics and College of Optical Sciences, The University of Arizona, Tucson, AZ 85721, USA — Cavity-enabled optomechanical cooling and trapping of mirrors has lately become experimentally feasible, indicating the possibility of reaching the quantum mechanical ground state of a macroscopic mirror. All theory and experiment so far has been based on the exchange of *linear* momentum between light beams and vibrating mirrors. We consider Laguerre-Gaussian beams carrying *angular* momentum in a cavity made of two highly reflective spiral phase elements. We show that this configuration should enable the optical trapping and cooling of the rotational motion of the movable cavity end-mirror down to its quantum mechanical ground state [1], as well as robust entanglement of its ro-vibrational modes [2].

[1] M. Bhattacharya and P. Meystre, Phys. Rev. Lett. **99**, 153603-1 (2007).
[2] M. Bhattacharya, P.-L. Giscard and P. Meystre, Phys. Rev. Lett. submitted.

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