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Cavity cooling of $^{88}Sr^{+}$ DAVID LEIBRANDT, YAT SHAN AU, ISAAC CHUANG, MIT — Cavity cooling is a method of laser cooling which uses coherent scattering to cool atoms [V. Vuletić and S. Chu, PRL **84**, 3787 (2000)]. The closed atomic transition used in Doppler cooling is replaced by a cavity resonance, so cavity cooling can be used to cool to sub-Doppler temperatures and is in principle applicable to complicated atoms or molecules without closed transitions. We describe an experiment to study three-dimensional cavity cooling of a single $^{88}Sr^{+}$ ion confined in a linear RF Paul trap. Large cooling rates can be attained by operating near the 422 nm $S_{1/2} \leftrightarrow P_{1/2}$ optical dipole transition and using a 5 cm long near-confocal Fabry-Pérot cavity with commercially available mirrors of finesse 10^4. Given a cavity alignment error ≤ 10 μm and a trap frequency of 1 MHz, the resolved sideband cavity cooling limit is ≤ 5 motional quanta. We present details of the experimental proposal and its implementation.

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