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Multi-Photon Magneto-Optical Trapping ROGER BROWN, SAI-JUN WU, THOMAS PLISSON, WILLIAM PHILLIPS, J.V. PORTO, JQI — We demonstrate a Magneto-Optical Trap (MOT) configuration which employs optical forces due to light scattering between two electronically excited states of Cesium. A multi-photon cooling mechanism allows for the replacement of standard MOT beams in up to 4 of the usual 6 directions with MOT beams connecting excited to further excited states. The multi-photon mechanism creates cooling and trapping on both red and blue sides of the two-photon resonance. The new configuration also exhibits many of the same experimentally appealing features found in a standard MOT including: efficient capture from a vapor cell, densities approaching 10^{11} atoms per cubic cm and sub-Doppler temperatures. Operating this multi-photon MOT in a far single photon detuned regime, we observe sub-Doppler temperatures on the blue side of two photon resonance indicating a fundamentally different two color polarization gradient cooling effect. Possible applications of this MOT are improved single-atom detection by efficiently collecting fluorescence along the path of the excited MOT beams, using optical filters to separate the fluorescence from the trapping light, and the ability to trap new species with inconvenient laser wavelengths by relaxing power requirements on the MOT beams. PRL 103, 173003

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