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Full Characterization of Two-beam Magneto-optical Trap

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In standard magneto-optical trap (MOT), three pairs of cooling beams orthogonally intersect at the magnetic field minimum produced by anti-Helmholtz coils. The degree of off-centering seriously determines the trapping velocity, lowest temperature reached, decoherence time, and the shape and density of the cold atomic cloud. Our alternative two-beam trap was designed for efficiently cooling and capturing rubidium-85 atoms while maximizing the optical accessibility to the cold gas. In contrast to the MOT, only two focused counter propagating laser beams were employed. The confocal configuration provides additional trapping force due to spatial light shift in the transverse direction with respect to the beam axis while the trap potential is still predominated by the interplay between the Doppler shift and Zeeman shift. Here, we have performed the first full characterization of the two-beam trap and discussed parameters that influence the trap efficiency. The trap number, temperature, density and geometry of the atomic cloud are compared with the standard MOT.

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