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Reabsorption Mitigation Using Frequency-Broadened Light[1] ANTHONY GORGES, ANSEL FOXLEY, DAVID FRENCH, JACOB ROBERTS, Colorado State University — The reabsorption of photons in optically thick gases of ultracold atoms presents a critical limitation to the efficient optical pumping of these gases. In particular, this limitation severely hampers many laser-based cooling schemes. We present measurements that show that the reabsorption probability can be reduced by using light with a broad frequency spectrum. This reduction is expected since reabsorption depends on a two-photon spontaneous Raman scattering processes that involves a spontaneously emitted photon and a pump photon with the same frequency, and in a sufficiently broad source this condition is met for only a fraction of the light. In one set of measurements, we observed the reduction in reabsorption by comparing the amount of heat imparted to ultracold ^{85}Rb atoms in an optically thick cloud by two independent lasers as compared to the heat imparted by these lasers individually while keeping the total intensity constant. Also, experiments to reduce the reabsorption with a single laser whose frequency is broadened using an AOM and multiple RF drive frequencies were also performed. The results suggest that the frequency broadening of an optical pumping laser is beneficial for the efficient optical pumping of optically thick ultracold gases.

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