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Velocity-selective two-photon resonances in a cold atomic sample with large one-photon blue detunings MATTHEW TERRACIANO, SPENCER OLSON, MARK BASHKANSKY, ZACHARY DUTTON, FREDRIK FATEMI, Naval Research Laboratory — We present experimental results on velocity-selective, magnetically-induced resonances in a cold Rb vapor. For small detuning from the D2 transition ($|\Delta| < 50$ MHz), we observe cooling only for negative Δ as expected, but at larger detuning ($|\Delta| \approx 0.1$-10 GHz) we find evidence for cooling with both blue- and red-detuning. To observe this effect, a freely expanding atom cloud is exposed to a $\sim$1-10 ms pulse from lin-perp-lin counterpropagating fields. The expanding cloud is later imaged and shows higher density for a narrow velocity class of atoms that is resonant with a two-photon transition whose Doppler shift corresponds to the Larmor precession frequency. We use this effect to demonstrate a simple technique for measuring (or zeroing) the magnetic field to within 1 mG, as verified by Faraday rotation. Furthermore, we cool several velocity classes simultaneously by imposing multiple frequency sidebands on one beam of the counterpropagating pair, and extend the experiments to two dimensions.

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