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Imaging velocity selective resonances in a magnetic field[1] FREDRIK FATEMI, MATTHEW TERRACIANO, MARK BASHKANSKY, ZACHARY DUTTON, Naval Research Laboratory — We demonstrate a simple technique for single-shot imaging of a magnetic field using stimulated Raman transitions. Freely expanding cold atoms released from a magneto-optical trap are exposed to a brief ($\sim$1 msec) retro-reflected laser pulse in a lin-perp-lin configuration detuned a few GHz from resonance. Because the two-photon resonance condition is satisfied only for narrow velocity classes, most atoms continue freely expanding. In contrast, the momentum of resonant atoms is altered by the pulse, and this two-photon momentum change is easily visible after further ballistic expansion. When the momentum pulse is applied to an atom cloud with finite size, magnetic field variations across the sample result in position-dependent features in images of the expanded cloud. Furthermore, when the stimulated Raman transitions occur between different hyperfine ground states, the resonance condition is dependent on the initial magnetic sublevel quantum number. We have used this technique for single-shot imaging of magnetic sublevel distributions.

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