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New technique for "non-destructively" imaging cold alkali atom clouds[1] ANAND RAMANATHAN, SERGIO MUNIZ, KEVIN WRIGHT, WILLIAM PHILLIPS, GRETCHEN CAMPBELL, Joint Quantum Institute UMD/NIST Gaithersburg, KRISTIAN HELMERSON, School of Physics, Monash University, Melbourne, Australia — In most cold atom experiments obtaining an image of the atomic cloud involves destroying the sample. Phase-contrast imaging can be used to get spatial density information with minimal perturbation of the sample, however, poor detection efficiency can greatly reduce the signal to noise ratio (S/N) obtained. We present a method which uses the ground state hyperfine structure and the D_2 cycling transition of alkali atoms to allow us to scatter many photons off each "destroyed" atom, greatly compensating for optical detection losses. In our imaging technique, we transfer a small fraction (around 10%) of the atoms from the $F = 1$ hyperfine ground state to the $F = 2$ ground state using a microwave or Raman pulse and then image those atoms with resonant probe light. The $F = 2$ atoms leave the trap while the remaining $F = 1$ atoms are not affected by the probe. The S/N is ultimately limited by statistical variation in the transfer fraction. This method works well even for optically thin atomic clouds. We use this partial transfer method to take multiple images of the same Bose-Einstein condensate.

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