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Optimal detuning for atomic interferometry

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Atomic beam manipulation by scattering the atomic waves from the light waves is a well established field. In particular, the manipulation, if coherent, can be an essential step to construct an atomic interferometry. We show an atomic interferometry in parallelogram arrangement based on a concept of coherent population transfer using an optimal detuning. The transfer via stimulated Raman-transitions between the J=1 Zeeman states through the upper state of J=0 are essential in the coherent manipulation of atomic beams. The coherent splitting, mirror, and combination, resulting in no phase shift of finally combined atomic beams in the parallelogram arrangement, are achieved using two perpendicular beams of the and -polarized lasers. The center-lines of the laser beams cross each other in order that the atoms see two pulses not delayed. It is remarkable that the optimal-detuning transfer, like the adiabatic-passage transfer, making the atomic beam manipulations coherent only with a detuning control, may be a powerful tool for atomic interferometry.