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Optical Manipulation of BEC's using the Talbot Effect MARK EDWARDS, Georgia Southern University — Gaseous Bose-Einstein condensates (BEC) can be placed in novel momentum states by applying two high-intensity, short-pulse counterpropagating laser pulses separated by a variable time delay[1]. The long-time momentum state of the condensate, which consists of a superposition of integral multiples of $2\hbar k$ (twice the laser photon momentum,) depends on the delay between the pulses and their relative intensites. We have extended the theory to apply to a sequence of pulses and delays. The effect of a laser pulse on the condensate momentum state is that the amplitude to jump from momentum eigenstate $2m\hbar k$ to $2n\hbar k$ is $i^{n-m}J_{n-m}(\alpha)$ where α is proportional to the laser intensities. Between the pulses, each momentum component evolves as a free particle with the appropriate momentum. Using these two elements, any sequence of pulses and delays can be analyzed. We present this theory in detail and analyze a sequence of pulses and delays designed to place the condensate atoms in a state with only two (equal and opposite) momentum components.

[1] L. Deng et al.,*Temporal Matter-Wave-Dispersion Talbot Effect* Phys. Rev. Lett. **83** 5407 (1999)

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