Collinear Four-Wave Mixing of Two-Component Matter Waves

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Theoretical Description:
Coupled-mode Expansion of GPE

\[ \Phi_n(t) = \left\{ \begin{array}{ll} \Phi_{n1}(t) & \text{for mode } n_1 \neq n_2 \\ \Phi_{n1}(t) & \text{for mode } n_1 = n_2 \end{array} \right. \]

Mode Populations after FWM depending on initial fraction of each component

Temporal growth of output mode population

\[ N_n(t) = \frac{1}{2} \left[ (n+1)^2 (n+2)^2 - n^2 (n-1)^2 \right] \]

Conservation of particle number in A and B and of total spin.

Initial State Prep.

After Release & Time of Flight

Four-wave Mixing (FWM)

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How about an adiabatically ramped up lattice?

→ FWM can mask/mimic in-situ interaction effects

Macrosopic spin entanglement

Coherent pseudospin exchange

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