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Atomic population distribution in the output ports of a waveguide interferometer with optical splitting and recombination EBUBECHUKWU ILO-OKEKE, ALEX ZOZULYA, Worcester Polytechnic Institute — Manipulation of atomic Bose-Einstein condensates (BECs) in an atom waveguide interferometer relies on the use of off-resonant laser pulses to split a cloud of BEC into two clouds that travel along different paths and are then recombined using the same laser pulses. During the evolution of the condensates, residual spatial-dependent phase is accumulated due to the confining potential and the interatomic interactions within the condensates. Additional phase is accumulated due to the mode-entangled state of the clouds after splitting that causes each atom in the condensate to evolve at a different rate. The recombination laser pulses are sensitive to these phases and the population of atoms in the atomic samples that emerge after recombination depends on them. We derive an expression for the probability density distribution of observing any number of atoms in the clouds after recombination and give a parameter space for optimum operation of the interferometer in the presence of phase due to mode-entangled state of BEC clouds and the residual spatial-dependent phase.

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