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Controlling the group velocity of colliding atomic Bose-Einstein condensates with Feshbach resonances RANCHU MATHEW, EITE TIESINGA, Joint Quantum Institute — We report on a proposal to change the group velocity of a small Bose Einstein Condensate (BEC) upon collision with another BEC in analogy to slowing of light passing through dispersive media. We make use of ultracold collisions near a magnetic Feshbach resonance, which gives rise to a sharp variation in scattering length with collision energy and thereby changes the group velocity. A generalized Gross-Pitaveskii equation is derived for a small BEC moving through a larger stationary BEC. We denote the two condensates by laser and medium BEC, respectively, to highlight the analogy to a laser pulse travelling through a medium. We derive an expression for the group velocity in a homogeneous medium as well as for the difference in distance, δ, covered by the laser BEC in the presence and absence of a finite-sized medium BEC with a Thomas-Fermi density distribution. For a medium and laser of the same isotopic species, the shift δ has an upper bound of twice the Thomas-Fermi radius of the medium. For typical narrow Feshbach resonances and a medium with number density 10^{14} cm^{-3} up to 85% of the upper bound can be achieved, making the effect experimentally observable. We also derive constraints on the experimental realization of our proposal.

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